APPENDIX C

Preliminary Soil Contamination Report

PALM LAKE WORKS PTY LTD

PRELIMINARY SOIL CONTAMINATION REPORT

PROPOSED RESIDENTIAL SUBDIVISION
LOT 156 DP 628026 CREEK STREET
HASTINGS POINT NSW

OPUS QANTEC McWILLIAM

1 / 10 Rivendell, TWEED HEADS SOUTH NSW 2486
PO Box 6389, TWEED HEADS SOUTH NSW 2486

Telephone: 07 5523 1755
Facsimile: 07 5523 9664
E-mail: tweedheads@opusqmcw.com.au

MARCH 2008

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PROJECT NAME:

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AUTHOR:

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REVISION / ISSUE RECORD

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	REVISION No. / Qty Issued				
RECIPIENT	**A**	**B**	**C**	**D**	**E**

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ALS ENVIROMENTAL TESTING RESULTS - DATED 12 JULY 2004

1. INTRODUCTION

Palm Lake Works Pty Ltd have instructed Opus Qantec McWilliam to undertake a preliminary contaminated soil report for their property at Lot 156 DP 628026 Creek Street, Hastings Point, NSW. The report forms part of an assessment for proposed filling as a precursor to residential development of the property. This contamination report is to be read in conjunction with the Impact Assessment and should not be used for any other purpose.

2. SCOPE

This is a Preliminary Soil Contamination Report. The purpose is to identify areas of potential contaminated soils, which may otherwise be suitable, for residential land uses.

The investigation specifically targets contaminates used in the banana industry and agriculture in general. That is arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury, organochlorine and organophosphorous pesticides.

2.1 IDENTIFICATION

The property description is Lot 156 DP 628026 in the Parish of Cudgen, County of Rous in the Shire of Tweed. The locality is illustrated in Figure 1.0 of the Engineering Impact Assessment.

3. SITE HISTORY

A detailed site history was not available at the time of reporting. Anecdotal inquiries reveal the site has been used for cattle grazing. However, this did not preclude small crops and banana growing in the past. The testing has targeted those land uses.

4. SITE CONDITION & SURROUNDING ENVIRONMENT

The land is partially zoned 2(e) Residential Tourist and partially 7(a) Environmental Protection (Wetlands and Littoral Rainforest) under Tweed LEP 2000.

The site is located on the southern side of Creek Street and the western side of Coast Road. This is depicted in Figure 1.0 of the Engineering Impact Assessment. The site is characterised by relatively level land with the exception of some scattered holes. The site is grassed and generally cleared of trees.

Parent soil type is identified as predominantly silty sand of the Cobaki Landscape variety (Land and Water Conservation, 1996).

5. SAMPLING & ANALYSIS METHODOLOGY

The desktop assessment did not preclude previous crop growing. Therefore, a systematic sampling pattern was carried out by Soil Surveys Engineering Pty Ltd and tested by a NATA registered soil testing and sampling laboratory (ALS Environmental). The density of samples and the methodology is described in Table A of EPA NSW Contaminated Sampling Design Guidelines. Samples were collected from a depth of 150mm below the vegetated layer. The sample handling was carried out in general accordance with Section 2.5 of the EPA Guidelines for Assessing Banana Plantation Sites.

22 composite samples were made up from the individual samples from 75 test locations as illustrated in Figure 2.0. These composite samples were sent under Chain of Custody to a NATA testing laboratory.

Details of sampling locations by Soil Surveys Engineering Pty Ltd and testing results from ALS Environmental are presented in Appendix A and B respectively

5.1 BASIS FOR ASSESSMENT

The human health investigation thresholds listed in Table 1 of the National Environmental Health Forum were used for assessing the selected contaminants listed in the table. The EPA Guidelines for Assessing Banana Plantation Sites were also referenced given values outlined in the guidelines were used as they provide more conservative thresholds for contaminants than the Health-based soil investigation levels provided by the National Environmental Health Forum. These values are reproduced below for reference.

INVESTIGATION THRESHOLD	
CONTAMINANT	**THRESHOLD CONCENTRATION (mg/kg dry weight)**
Arsenic.	100
Lead.	300
Chromium	100
Copper	1000
Nickel	600
Zinc	7000

The sample results were evaluated in accordance with Section 2.4.2 of the EPA Guidelines. That is where composite subsamples are tested:

- If the individual result is less than 25% higher than the investigation threshold then the site can be considered uncontaminated.
- If any subsamples have a contamination level greater than 25% or the 95% upper confidence level exceed the threshold then the site is considered contaminated.

5.2 RESULTS

Initial sampling was performed on 22 June 2004. The report by Soil Surveys Engineering contained in Appendix B of the Engineering Impact Assessment gives the locations and detailed numbering of the samples. The sampling test locations and detailed results are reproduced in Appendix A and B respectively. In summary the results show:

- From twenty two tested laboratory samples, ranges of contaminants from testing that were greater than the limit of reporting were as follows.
  - Arsenic. (Range <1- 3 mg/kg).
  - Lead. (Range <1- 38 mg/kg).
  - Chromium (Range <1- 3 mg/kg).
  - Copper (Range <1- 8 mg/kg).
  - Nickel (Range <1- 2 mg/kg).
  - Zinc (Range <1- 95 mg/kg).
  - Organochloride pesticides (DDT, aldrin, dieldrin). (Below Level of Reading)
  - Organophosphorous pesticides. (Below Level of Reading)

- The Individual sample # 2044808 19A gave the values.
  - Lead. (Range 38 mg/kg).
  - Copper (Range 8 mg/kg).
  - Nickel (Range 2 mg/kg).
  - Zinc (Range 95 mg/kg).

All contaminants are well below the stated threshold's the higher values gained from the 19A sample can be viewed as a confined case as all other sample values range from <1 -3 mg /kg on average.

6. CONCLUSIONS & RECOMMENDATIONS

We conclude that this site is not contaminated and is suitable for residential use.

7. REFERENCES

LAND AND WATER CONSERVATION	(1996)	Soil landscapes of the Murwillumbah – Tweed Heads 1:100,000 Sheet
NATIONAL ENVIRONMENTAL HEALTH FORUM	(1998)	Health-Based Soil Investigation Levels. Soil Series No. 1. 2nd Edition
NATIONAL ENVIRONMENTAL HEALTH FORUM	(1996)	Composite Sampling. Soil Series No. 3.
NSW ENVIRONMENT PROTECTION AUTHORITY	(1997)	Contaminated Sites. - Guidelines for Assessing Banana Plantation Sites. - Guidelines for Consultants Reporting on Contaminated Sites.
NSW ENVIRONMENT PROTECTION AUTHORITY	(1995)	Contaminated Sites. - Sampling Design Guidelines.

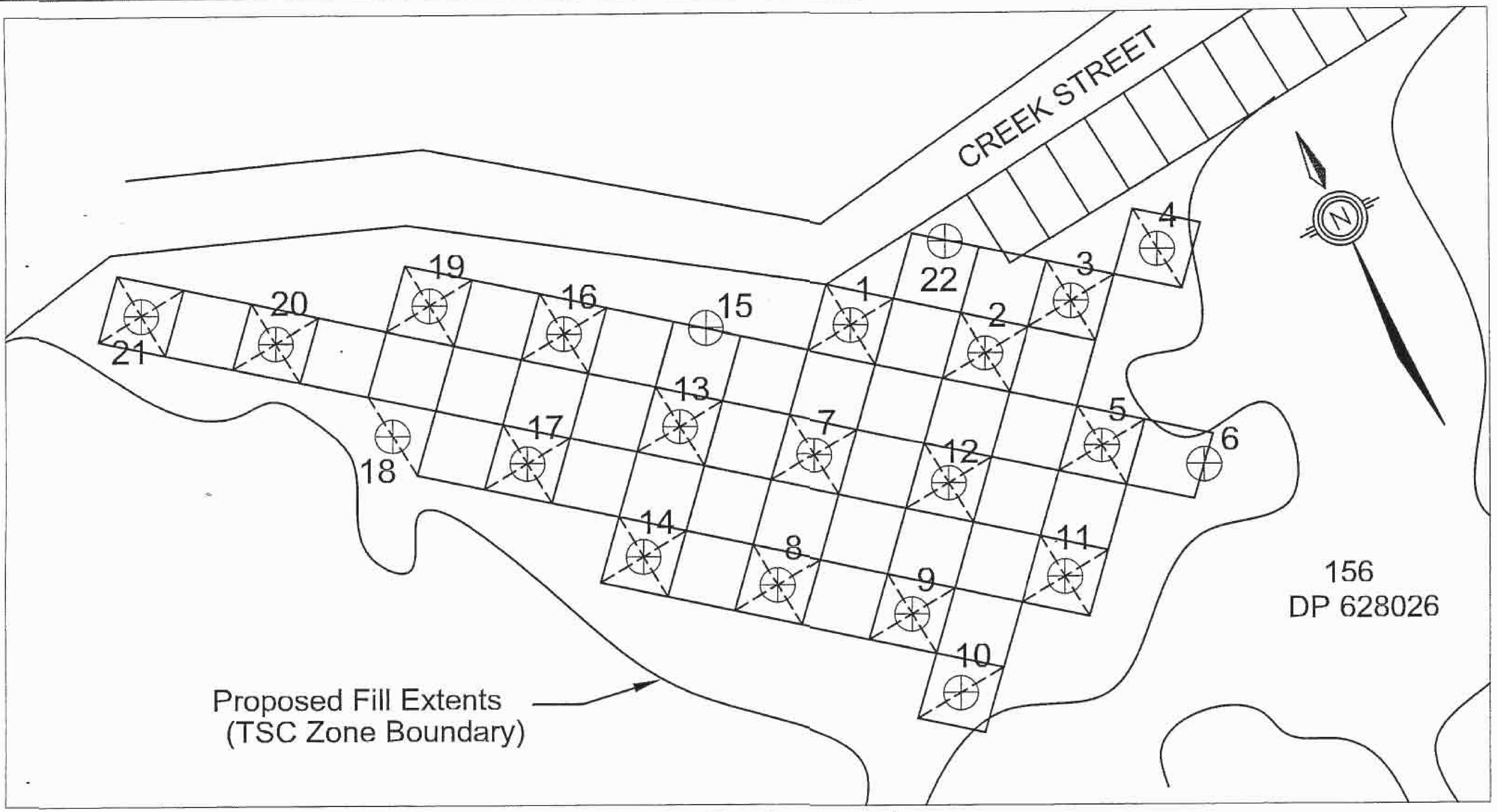
Report Prepared By	Approved for Issue
TRAVIS SERESHEFF	**MARTIN FINDLATER**
Engineer	Branch Manager
	RPEQ 1969

APPENDIX A

SOIL SURVEYS ENGINEERING PTY LTD

CONTAMINATION TESTING LOCATIONS PLAN

(PRELIMINARY SOIL CONTAMINATION REPORT)



Contamination Testing Locations

X:/drafting/[illegible]E Auto[illegible]dwg/Nerang/204-4808-03

2.5 0 7.5 12.5m

SCALE 1:250

DRAWN D.D.	Soil Surveys SOIL SURVEYS ENGINEERING PTY.LIMITED CONSULTING GEOTECHNICAL ENGINEERS		
DATE 28.06.2004	SITE PLAN Proposed Filling Creek Street, Hastings point N.S.W.	DRAWING NO. 204-4808 -03	A4
CHECKED			

APPENDIX B

ALS ENVIRONMENTAL TESTING RESULTS – DATED 12 JULY 2004

(PRELIMINARY SOIL CONTAMINATION REPORT)

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	:	SOIL SURVEYS ENGINEERING P/L	Laboratory	:	ALS Environmental Brisbane	Page	: 1 of 12
Contact	:	PATRICK KIDD	Contact	:	Michael Heery		
Address	:	9/39 LAWRENCE DRIVE NERANG QLD AUSTRALIA 4211	Address	:	32 Shand Street Stafford QLD Australia 4053	No. of samples	: 22
Project	:	204 4808	Quote number	:	----	Date received	: 29 Jun 2004
Order number	:	B5702	Unique Report ID	:	00701	Date issued	: 12 Jul 2004
C-O-C number	:	- Not provided -					
Site	:	- Not provided -					
E-mail	:	pkidd@soilsurveys.com.au	E-mail	:	Michael.Heery@alsenviro.com	Work order	: **EB0403190**
Telephone	:	(07)5596-1528	Telephone	:	61-7-32437222		
Facsimile	:	(07)5578-3916	Facsimile	:	61-7-32437259		

This final report was issued on Monday, July 12, 2004 for the ALSE work order reference EB0403190 and supersedes any reports with this reference.
Results apply to the samples as submitted. All pages of this report have been checked and approved for release.
ND: Unable to determine the result due to sample matrix interference.
Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.

ALSE - QUALITY, SERVICE and TECHNOLOGY provided GLOBALLY

NATA Accredited Laboratory - 825

The Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced except in full.

This document has been digitally signed by those names who appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Greg Greenland	Senior Organic Chemist	Inorganics - NATA 818 (Brisbane)
Greg Greenland	Senior Organic Chemist	Organics - NATA 818 (Brisbane)
Kim McCabe	Inorganics Supervisor	Inorganics - NATA 818 (Brisbane)
Shaun Crabb	Metals Team Leader	Inorganics - NATA 818 (Brisbane)

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). *Abbreviations:* ***CAS number*** = *Chemical Abstract Services number,* ***LOR*** = *Limit of Reporting.* ***# Indicates a raised LOR.***

When date(s) are shown bracketed, these have been assumed by the laboratory for process purposes.

Analytical Results

				Client Sample ID :	204 4808 1A	204 4808 2A	204 4808 3A	204 4808 4A	204 4808 5A
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
				Laboratory Sample ID :	EB0403190-001	EB0403190-002	EB0403190-003	EB0403190-004	EB0403190-005
Analyte	*CAS number*	*LOR*	*Units*						
EA055: Moisture Content									
Moisture Content (dried @ 103°C)		0.1	%		4.8	7.5	9.5	6.4	5.1
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	1	mg/kg		<1	<1	<1	<1	<1
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	1	mg/kg		<1	<1	<1	<1	<1
Copper	7440-50-8	1	mg/kg		<1	<1	<1	<1	<1
Lead	7439-92-1	1	mg/kg		<1	<1	2	<1	<1
Nickel	7440-02-0	1	mg/kg		<1	<1	<1	<1	<1
Zinc	7440-66-6	1	mg/kg		1	<1	1	1	2
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4,4'-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4,4'-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4,4'-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

ALS Environmental

Analytical Results

	Client Sample ID :	204 4808 1A	204 4808 2A	204 4808 3A	204 4808 4A	204 4808 5A
	Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
	Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
	Laboratory Sample ID :	EB0403190-001	EB0403190-002	EB0403190-003	EB0403190-004	EB0403190-005
Analyte	*CAS number*	*LOR*	*Units*			
EP068B: Organophosphorus Pesticides (OP)						
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Demeton-S-methyl	8022-00-2	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Bromophos-ethyl	2104-96-3	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE		0.1	%	113	108	94.0	117	112
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	113	109	95.8	111	119

ALS Environmental

Analytical Results

				Client Sample ID :	204 4808 6A	204 4808 7A	204 4808 8A	204 4808 9A	204 4808 10A
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
				Laboratory Sample ID :	EB0403190-006	EB0403190-007	EB0403190-008	EB0403190-009	EB0403190-010
Analyte	*CAS number*	*LOR*	*Units*						
EA055: Moisture Content									
Moisture Content (dried @ 103°C)		0.1	%		2.7	5.3	15.9	10.7	3.2
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	1	mg/kg		<1	<1	3	2	2
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	1	mg/kg		<1	<1	1	<1	<1
Copper	7440-50-8	1	mg/kg		<1	<1	<1	<1	<1
Lead	7439-92-1	1	mg/kg		<1	<1	1	2	1
Nickel	7440-02-0	1	mg/kg		<1	<1	<1	<1	<1
Zinc	7440-66-6	1	mg/kg		<1	<1	3	2	<1
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4'-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4'-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
4.4'-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	8022-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

ALS Environmental

Analytical Results

	Client Sample ID :	204 4808 6A	204 4808 7A	204 4808 8A	204 4808 9A	204 4808 10A
	Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
	Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
	Laboratory Sample ID :	EB0403190-006	EB0403190-007	EB0403190-008	EB0403190-009	EB0403190-010
Analyte	*CAS number*	*LOR*	*Units*					
EP068B: Organophosphorus Pesticides (OP)								
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	2104-96-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE		0.1	%	112	112	115	114	117
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	114	111	115	117	117

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Analytical Results

				Client Sample ID :	204 4808 11A	204 4808 12A	204 4808 13A	204 4808 14A	204 4808 15A
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
				Laboratory Sample ID :	EB0403190-011	EB0403190-012	EB0403190-013	EB0403190-014	EB0403190-015
Analyte	*CAS number*	*LOR*	*Units*						
EA055: Moisture Content									
Moisture Content (dried @ 103°C)		0.1	%		5.6	4.3	33.5	21.1	4.9
EG005T: Total Metals by ICP-AES									
Arsenic	7440-38-2	1	mg/kg		<1	<1	<1	1	<1
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	1	mg/kg		<1	<1	<1	<1	<1
Copper	7440-50-8	1	mg/kg		<1	<1	<1	<1	<1
Lead	7439-92-1	1	mg/kg		2	<1	1	<1	<1
Nickel	7440-02-0	1	mg/kg		<1	<1	<1	<1	<1
Zinc	7440-66-6	1	mg/kg		2	<1	1	3	1
EG035T: Total Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4.4'-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4.4'-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
4.4'-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Demeton-S-methyl	8022-00-2	0.05	mg/kg		<0.05	<0.05	# <0.06	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2

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Analytical Results

	Client Sample ID :	204 4808 11A	204 4808 12A	204 4808 13A	204 4808 14A	204 4808 15A
	Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
	Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00	22 Jun 2004 15:00
	Laboratory Sample ID :	EB0403190-011	EB0403190-012	EB0403190-013	EB0403190-014	EB0403190-015
Analyte	*CAS number*	*LOR*	*Units*			
EP068B: Organophosphorus Pesticides (OP)						
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Bromophos-ethyl	2104-96-3	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	# <0.06	<0.05	<0.05
EP068S: Organochlorine Pesticide Surrogate						
Dibromo-DDE		0.1	%	115	117	93.6	87.6	93.2
EP068T: Organophosphorus Pesticide Surrogate						
DEF	78-48-8	0.1	%	115	115	93.7	83.6	91.2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 204 4808 16A Sample Matrix Type / Description: SOIL / SOIL Sample Date / Time: 22 Jun 2004 15:00 Laboratory Sample ID: EB0403190-016	204 4808 17A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-017	204 4808 18A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-018	204 4808 19A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-019	204 4808 20A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-020
EA055: Moisture Content								
Moisture Content (dried @ 103°C)		0.1	%	57.1	24.5	12.6	12.0	32.8
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	1	mg/kg	2	2	<1	<1	2
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	1	mg/kg	3	2	<1	<1	2
Copper	7440-50-8	1	mg/kg	<1	<1	<1	8	<1
Lead	7439-92-1	1	mg/kg	3	1	<1	38	2
Nickel	7440-02-0	1	mg/kg	<1	<1	<1	2	<1
Zinc	7440-66-6	1	mg/kg	2	2	4	95	1
EG035T: Total Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
beta-BHC	319-85-7	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
gamma-BHC	58-89-9	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
delta-BHC	319-86-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Heptachlor	76-44-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Aldrin	309-00-2	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Heptachlor epoxide	1024-57-3	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
trans-Chlordane	5103-74-2	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
alpha-Endosulfan	959-98-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
cis-Chlordane	5103-71-9	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Dieldrin	60-57-1	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
4.4'-DDE	72-55-9	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Endrin	72-20-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
beta-Endosulfan	33213-65-9	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
4.4'-DDD	72-54-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Endrin aldehyde	7421-93-4	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Endosulfan sulfate	1031-07-8	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Demeton-S-methyl	8022-00-2	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: 204 4808 16A Sample Matrix Type / Description: SOIL / SOIL Sample Date / Time: 22 Jun 2004 15:00 Laboratory Sample ID: EB0403190-016	204 4808 17A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-017	204 4808 18A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-018	204 4808 19A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-019	204 4808 20A SOIL / SOIL 22 Jun 2004 15:00 EB0403190-020
EP068B: Organophosphorus Pesticides (OP)								
Dimethoate	60-51-5	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Diazinon	333-41-5	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Fenthion	55-38-9	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Chlorpyrifos	2921-88-2	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Chlorfenvinphos	470-90-6	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Bromophos-ethyl	2104-96-3	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Fenamiphos	22224-92-6	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Prothiofos	34643-46-4	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Ethion	563-12-2	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Carbophenothion	786-19-6	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
Azinphos Methyl	86-50-0	0.05	mg/kg	# <0.12	<0.05	<0.05	# <0.06	# <0.12
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE		0.1	%	86.7	115	98.9	94.9	94.0
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	88.8	119	99.2	100	98.2

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Analytical Results

	Client Sample ID :	204 4808 21A	204 4808 22A			
	Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL			
	Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00			
	Laboratory Sample ID :	EB0403190-021	EB0403190-022			
Analyte	*CAS number*	*LOR*	*Units*			
EA055: Moisture Content						
Moisture Content (dried @ 103°C)		0.1	%	23.6	2.4	
EG005T: Total Metals by ICP-AES						
Arsenic	7440-38-2	1	mg/kg	<1	<1	
Cadmium	7440-43-9	1	mg/kg	<1	<1	
Chromium	7440-47-3	1	mg/kg	<1	<1	
Copper	7440-50-8	1	mg/kg	<1	<1	
Lead	7439-92-1	1	mg/kg	1	<1	
Nickel	7440-02-0	1	mg/kg	<1	<1	
Zinc	7440-66-6	1	mg/kg	<1	<1	
EG035T: Total Mercury by FIMS						
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	
EP068A: Organochlorine Pesticides (OC)						
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	
4.4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	
4.4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	
4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	
EP068B: Organophosphorus Pesticides (OP)						
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	
Demeton-S-methyl	8022-00-2	0.05	mg/kg	<0.05	<0.05	
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	

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Analytical Results

	Client Sample ID :	204 4808 21A	204 4808 22A			
	Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL			
	Sample Date / Time :	22 Jun 2004 15:00	22 Jun 2004 15:00			
	Laboratory Sample ID :	EB0403190-021	EB0403190-022			
Analyte	*CAS number*	*LOR*	*Units*			
EP068B: Organophosphorus Pesticides (OP)						
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	
Bromophos-ethyl	2104-96-3	0.05	mg/kg	<0.05	<0.05	
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	
EP068S: Organochlorine Pesticide Surrogate						
Dibromo-DDE		0.1	%	94.5	97.7	
EP068T: Organophosphorus Pesticide Surrogate						
DEF	78-48-8	0.1	%	91.8	93.7	

ALS Environmental

Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Preparation Methods

EN69: Hot Block Digest for metals in soils sediments and sludges - Nitric/Hydrochloric Acid Digestion with H2O2 Leach (USEPA 200.2 mod, ALS QWI EN/69) This method (adapted from USEPA 200.2) utilizes Nitric / Hydrochloric acid and a 'Hot Block' apparatus for the digestion of total recoverable metals from sediments, sludges and soils.

ORG17A: Tumbler Extraction of Solids (Option A - Concentrating) - (In-house - Mechanical agitation (tumbler), ALS QWI-ORG/17 Option A) 20+0.05 g of sample and an appropriate drying agent (Na2SO4) is transferred to an extraction bottle. 150mL of organic solvent (1:1 DCM/Acetone) is added and the bottle tumbled for two hours. The solvent is decanted from the bottle, dehydrated and concentrated to the desired volume for analysis.

Analytical Methods

EA055-103: Moisture Content - A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees Celcius.

EP068: Pesticides by GCMS - (USEPA SW 846 - 8270D, ALS QWI-ORG/EP068) Sample extracts (ALSQWI-ORG/17 Option A) are analysed by Capillary GC/MS. Quantification is achieved using internal standard and average response factor quantification techniques against an established five-point curve.

EG035T: Total Mercury by FIMS - (AS 3550, ALS QWI-EN/EG035-1): Flow Injection Mercury - Atomic Absorption Spectrometry (FIM-AAS) is a flameless atomic absorption technique. For the determination of total mercury, an oxidation stage using a bromate/bromide reagent is employed to oxidise organic mercury compounds. The ionic mercury is reduced to atomic mercury vapour by a reducing agent (SnCl2). Atomic mercury vapour is then purged into a heated quartz cell prior to quantification.

EG005T: Total Metals by ICP-AES - (APHA 20th ed., 3120; USEPA SW 846 - 6010; ALS QWI-EN/EG005): The ICPAES technique quickly breaks the sample down into atoms and ions under extremely hot plasma. Atoms are then ionized, emitting a characteristic spectrum. The spectrometer then separates the wavelengths, prior to comparison of intensities against matrix matched standards for quantification.

APPENDIX D

Sediment Basin Sizing calculation – RUSLE Method

REVISED UNIVERSAL SOIL LOSS EQUATION

Refer to NSW Dept of Housing
Managing Urban Stormwater Soils and Construction
A. Appendix for RUSLE
Chapter 6 for Settling Zone Volume

JOB No: 206012
DESCRIPTION: Walter Elliot Holdings - Hastings Point Subdivision

SEDIMENT STORAGE ZONE VOLUME

A = R K LS P C

Where		Description	Value	
A	=	**Computed soil loss (tonnes/ha/yr)**		
R	=	**Rainfall Erosivity Factor**		
	=	$164.74\ (1.1177)^{S}\ S^{0.6444}$	**5833.618085**	
			INPUT	
		S = 2 Year ARI, 6 Hour Storm Event	16	mm/h
K	=	**Soil Erodibility Factor**	0.075	From Soil Landscapes Manual
LS	=	**Slope Length / Gradient Factor**	0.2	From Table A1
P	=	**Erosion Control Practice Factor**	0.9	From Table A2
C	=	**Ground Cover**	1.00	From Table A3
A Soil Loss	=	**78.754 (tonnes/ha/year)**		
V Volume	=	**61 (m^3/ha/year)**		
		Disturbed Surface Area (ha)	5.5	ha
		Computed soil loss	**335.50**	m^3/year
		Sediment Storage Zone Volume	**168.00**	m^3 Assuming regeneration after
			6	Months

SEDIMENT BASIN VOLUME - Type F & D Soils

V = 10 Cv A R 75TH ile, 5 day (m^3)

10	=	Unit conversion Factor	**10**
Cv	=	The volumetric runoff coefficient, defined as that portion of rainfall that runs off as stormwater	0.69
A	=	Catchment Area of the Basin ha	5.5 ha
R (Y% ile, 5 day)	=	5 day rainfall depth not exceeded in y% of rainfall events. Refer Table 6.5 p 6-21	41.5 mm
V	=	**1574.925 m^3 Settling Zone Volume**	

TOTAL BASIN VOLUME = Settling Zone Volume + Sediment Storage Zone Volume

= 1742.93 m^3

= **1743 m^3**

BASIN VOLUME PER HECTARE = 317 m^3

APPENDIX E

Soil & Water Management Plan

PALM LAKE WORKS PTY LTD

PROPOSED RESIDENTIAL SUBDIVISON
LOT 156 DP 628026 CREEK STREET
HASTINGS POINT

SOIL AND WATER MANAGEMENT PLAN

THE SOIL & WATER MANAGEMENT PLAN

1. This plan is to be read in conjunction with:
   i) the engineering plans, and
   ii) any other plans or written instructions that may be issued and relating to development at the subject site.

2. Contractors shall ensure that all soil and water management works are:
   i) located as shown in the drawings, specification and Management Plan
   ii) constructed in accordance with the:
      - Tweed Shire Council – Development Design Specification D7 – Stormwater Quality (Annexure A).
      - NSW Department of Housing - Soil and Water Management for Urban Development.
      - NSW Environmental Protection Authority – Draft Managing Urban Stormwater Construction Activities.

3. The Contractor shall nominate a competent person to inspect erosion control structures, complete the site diaries and ensure the Soil and Water Management Plan is implemented.

4. The person nominated to implement the plan shall keep a copy on site.

OBJECTIVES

- To prevent sediment erosion being transported from the site by wind and water.

LAND DISTURBANCE

5. Other than for essential thinning of plant growth, land disturbance shall be limited to that necessary for implementation of the plans of works. Ideally, lands shall not be disturbed beyond five metres from the edge of any essential construction activity as shown on the engineering plans, other than in access zones. Such zones shall be clearly identified with barrier mesh or “silt” fencing or similar materials. The location of “silt” fences should be determined on site and may vary in position to best conserve the existing vegetation and protect downstream areas. The contractor shall ensure regular watering of exposed surfaces to minimise wind erosion.

6. Where practical, thinning of plant growth in the subdivision should be by hand or approved small machine. Small branches, leaf litter and other residues shall be retained as mulch.

7. Generally, works shall be undertaken in the following sequence:
   i) where possible, divert clean water likely to run onto lands to be disturbed
   ii) install sediment control works
   iii) strip and stockpile topsoil
   iv) undertake site development works in accordance with the engineering plans
   v) rehabilitate the site
   vi) remove soil and water management works.

8. Any temporary culverts or causeways to be installed across drainage reserves should be constructed only in areas of minimal erosion hazard. Such areas should be defined in consultation with the engineer.

EROSION CONTROL

9. The maximum water velocity in the design storm event in earth based waterways should be in accordance with Table 1.

TABLE 1

MAXIMUM FLOW VELOCITIES (m/sec)
IN EARTH BASED WATERWAYS *

GROUND COVER	VELOCITY (m/sec)
Mat or sward forming grasses with Enkamat ® or other UV stabilised mesh.	2.4
Kikuyu Grass.	1.9
Jute mesh (bitumen sprayed).	1.7
Couch grass, Rhodes grass, other sward forming grasses.	1.4
Other improved perennials.	0.9
Biodegradable blankets.	0.7
Tussock grasses.	0.5
Bare soil.	0.3

- This table assumes slope gradients of less than 10 percent and, other than for base soil, good (i.e. >80%) ground cover.

10. During road works, temporary crossbanks (bunds constructed with earth, straw bales or sandbags) should be constructed to limit slope length, where possible in accordance with Table 2.

TABLE 2

RECOMMENDED MAXIMUM SPACING BETWEEN CROSS DRAINS ON HAUL ROADS

SLOPE	MAXIMUM SPACING (metres)
0 to 7%	NN
7 to 10%	70
10 to 13%	32
13 to 16%	15
>16%	NR

NN – not necessary
NR – construction of haul roads not recommended.

11. Outlets from erosion or sediment control devices should be to stable disposal areas.

12. Earth batters should be:

    i) constructed with a maximum gradient of 2(H):1(V)
    ii) properly top soiled, seeded and mulched within two weeks from completion of works.

    A recommended listing of plant species is:

Spring/Summer sowing:	**Autumn/Winter sowings:**
Couch, hulled	Couch, hulled
Couch, unhulled	Couch, unhulled
Regal Ryegrass	Regal Ryegrass
Japanese Millet	Prairie Grass
Carpet Grass	Ryecorn/Oats
Haifa White Clover	Haifa White Clover
Redquin Red Clover	Crimson Clover

    The contractor is to nominate the mixture and application rates to be used to achieve the specified coverage. An approved grass mixture for seeding should contain Broad leaf Paspalm 30%, Carpet Grass 30% and Oats/Rye Grass 30%. The contractor shall provide a list of suitable native bush and tree species where required by the drawings.

13. The contractor should stage works and implement construction techniques to minimise the length of exposure to disturbed surfaces; topsoil and grass within two weeks of completion. Temporary rehabilitation should be undertaken on disturbed areas where works have stopped and soils are expected to remain exposed for more than two weeks before either works continue or permanent rehabilitation is undertaken. If vegetative means are used, the following species mix is recommended:

    Autumn/Winter sowing
    Oats/ryecorn @ 20kg/ha
    Japanese millet @ 10kg/ha

    Spring/Summer sowing
    Japanese millet @ 20 kg/ha
    Oats/ryecorn @ 10 kg/ha

    Alternatively, the contractor shall submit a substitute mix for approval.

14. On lands where rehabilitation to native plants is not essential, fertilisers/ameliorants should include:

    i) dolomite on topsoils at a rate of 2 kilograms per tonne of soil to raise the pH to be more conducive to growth of exotic species, particularly in waterways and other areas of high soil erosion hazard,
    ii) Grower 11 (or equivalent) at 250 kilograms per hectare and trace elements according to manufacturers instructions at sowing, and
    iii) Nitram (or equivalent) at 100 kilograms per hectare in the following Spring;

SEDIMENT CONTROL

15. Sediment retarding basins and sediment traps shall be constructed to contain the minimum storage specified on the engineering drawings.

16. Existing dams to be retained as sediment retarding basins are shown on the drawings.

17. “Silt” fences or straw bale sediment traps should be placed at regular intervals immediately downslope of all unprotected disturbed lands.

    - “Silt” fences, straw bale barriers, etc., should rarely be placed along the contour, as water will run to a low point in large storm events and the structure may fail. “Silt” fences should be placed with small returns at about five to thirty metres, creating a series of small sediment traps in line. This system has the added benefit of avoiding concentrated flows.

18. Sediment barriers (eg. sandbags or straw bales) should be located upstream of stormwater inlet pits prior to the road surface being paved. These barriers should be reinstalled after completion of paving if there are disturbed or bare areas nearby likely to contribute sediment to the road surface.

DUST CONTROL

Control Measures

19. The potential dust problems due to construction activities are to be ameliorated through the implementation of dust control measures. These measures are given in the table below.

FREQUENCY	CONTROL MEASURES
General operational practices	• Track-walked slopes • Surface rehabilitation • Limitation of topsoil stripping to current work areas • Stabilisation of stockpiles • Application of woodchip, mulching, organic matting or bitumen emulsions • Speed restriction for site vehicles • Roadways designated and maintained for site vehicles • Watering system utilised during rock face operations
Event based measures (upon identification of dust problem)	• Ensure operational practices are being carried out. • Watering of disturbed surfaces • Covering of disturbed areas and stockpiles awaiting vegetation growth • Provide screens around earthworks areas

Operational Times

20. The operational control measures are to be implemented at all times during site works. These times would depend on the contractor performing the works. Event based measures may be required outside of the operational times of the site upon identification of a dust problem.

Wind Conditions

21. During dry conditions with high winds a watering truck should be present on site during works.

Dust Monitoring

22. Monitoring of the dust emissions is to be carried out by visual inspection by the contractor.

Water Sources

23. Potable water from existing council mains is to be used for dust suppression. Alternatively water from sediment basins may be used when available.

CONSTRUCTION SEQUENCE

24. Works on the subdivision should be carried out in the following sequence:

    i) construction of sediment basin/trap
    ii) installation of barrier fencing and “silt” fencing
    iii) construct roadworks.

MAINTENANCE

25. The contractor shall:

    i) regularly maintain all soil and water management devices, including removal of accumulated sediment or trash, to ensure that more than 60 percent of the design capacity remains in the settling zone.
    ii) dispose of any sediment removed in areas where further pollution to downslope lands and waterways is unlikely.

INSPECTION

26. Inspections shall be undertaken:

    i) during any storm event that threatens to exceed the available capacity in sediment and pollution storage structures
    ii) after any storm that has caused runoff
    iii) daily, during hot or dry weather when grass cover is less than 100% on vegetated areas
    iv) weekly (on Fridays) as a matter of site routine for all site work practices
    v) before site closure or any other time when it might be otherwise unattended for more than twelve hours
    vi) testing as specified in the water quality monitoring program shall be carried out in accordance with the nominated schedule
    vii) signed, completed test results and inspection report shall be kept on site and made available on request to the engineer, Council officers and relevant authorities.

Installation

27. The contractor shall ensure a diary or record is kept documenting site work practices such as:

    i) dates of installation and removal of site work practices
    ii) repair of any damage to site work practices
    iii) rainfall depths, durations and times
    iv) storage capacity available in pollution control structures
    v) condition of site work practice structures and stabilised surfaces
    vi) time, date, volume and type of any additions of flocculants
    vii) estimates of water volumes discharged
    viii) estimates of pollutant volumes removed
    ix) water quality test results.

Program

28.
    i) Inspect catch drains, earth banks, table drains, and drop-down structures and clean as required.
    ii) Remove any stockpiled material or sediment that has encroached within two metres of a surface drain.
    iii) Restore any low spots in banks and drains to their original height and compact.
    iv) Where necessary, construct extra catch drains that help separate on-site dirty waters from other waters.
    v) Install any new erosion and sediment control measures that have become necessary since previous inspections because of severe storms or progress in the site's development.
    vi) Check to ensure that banks, channels and waterways are operating within the safe limits for their surface condition by noting any evidence of scour.
    vii) Ensure that any construction work at the site since the previous inspection has not diverted sediment and water away from any site work practice.

WATER QUALITY MONITORING PROGRAM

29. The contractor is to undertake a water quality monitoring and testing program to comply with the Department of Housing Guidelines and Clean Waters Act and Tweed Shire Council Design Specification D7 as tabulated below.

i) Monitoring

Parameter	Frequency	Reporting
Suspended Solids, Non Filterable Residue (NFR)	Monthly or during discharge event (defined as >25mm in any 24 hour period).	as per 26. Non complying test results are to be notified within 24 hours to Council officers.
pH	• if in acid sulfate soils risk area, daily or during controlled discharge event. • in areas with no identified acid sulfate risk, monthly and during controlled discharge event from sedimentation basins.	as per 26 Non comply test results are to be notified immediately to Council's Environmental & Health Services Unit.
Total P, Total N	3 monthly	as per 26

ii) Response to Monitoring, Non Compliance with ESCP, Amelioration Measures

Indicator	Response	Comments

pH too low <6.5	• If possible stop discharge and store runoff on site.
	• Respond in accordance with approved acid sulfate management plan or if no plan then:-
	  • Lime dose as per Acid Sulfate Soil Manual (Assmac), restore to acceptable pH before further discharge.
	  • Notify Council's Environmental & Health Services Unit of non compliant discharge (within 24 hours).
		Reporting as per 29 (i).

pH to high >8.5	• If possible stop discharge and store runoff on site. • Dilute with other water until pH in acceptable range. • Re-test for compliance before further discharge.	
Suspended Solids (NFR) >50mg/litre	Identify if non compliance is due to storm event greater than design storm of control devices. If so accept non compliance. If not then:- • If possible stop discharge and store runoff on site. • Use flocculation agents to lower NFR or • Pump contaminated water over grassed filter strips or buffer areas to lower NFR. • Identify (by inspection and/or analysis) if non compliance is due to damage of ineffectiveness of erosion and sediment control devices. Repair or redesign/replace if necessary (or required by Council) to ensure future compliance.	Non compliance may occur, by design, in >3 month (deemed to be 40% of the ARI one year event).

APPENDIX F

Intersection Calculation Summary

SIDRA INTERSECTION

Intersection Summary

Coast Road -Creek St Intersection

proposed upgrade

Performance Measure	Vehicles	Persons
Demand Flows - Total	752 veh/h	1128 pers/h
Percent Heavy Vehicles	2.8 %	
Degree of Saturation	0.165	
Effective Intersection Capacity	4569 veh/h	
95% Back of Queue (m)	3 m	
95% Back of Queue (veh)	0.4 veh	
Control Delay (Total)	0.40 veh-h/h	0.60 pers-h/h
Control Delay (Average)	1.9 s/veh	1.9 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS C	
Total Effective Stops	89 veh/h	134 pers/h
Effective Stop Rate	0.12 per veh	0.12 per pers
Proportion Queued	0.06	0.06
Travel Distance (Total)	258.8 veh-km/h	388.1 pers-km/h
Travel Distance (Average)	344 m	344 m
Travel Time (Total)	4.7 veh-h/h	7.1 pers-h/h
Travel Time (Average)	22.7 secs	22.7 secs
Travel Speed	54.6 km/h	54.6 km/h
Operating Cost (Total)	169 $/h	169 $/h
Fuel Consumption (Total)	23.0 L/h	
Carbon Dioxide (Total)	57.6 kg/h	
Hydrocarbons (Total)	0.083 kg/h	
Carbon Monoxide (Total)	2.70 kg/h	
NOX (Total)	0.112 kg/h	

SIDRA SOLUTIONS

Site: Coast Rd -Creek ST
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A1733, Opus Qantec McWilliam, Small Office
Produced by SIDRA Intersection 3.2.0.1455

www.sidrasolutions.com

SIDRA INTERSECTION

Movement Summary

Coast Road -Creek St Intersection

proposed upgrade

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Creek ST										
1	L	31	3.2	0.072	16.2	LOS C	3	0.46	0.78	25.7
3	R	31	3.2	0.072	9.4	LOS A	3	0.46	0.74	32.2
Approach		**62**	**3.2**	**0.072**	**12.8**	**LOS B**	**3**	**0.46**	**0.76**	**28.5**
Coast Road Sth										
4	L	31	3.2	0.017	7.4	LOS A	0	0.00	0.63	44.4
5	T	316	2.9	0.165	0.0	LOS A	0	0.00	0.00	60.0
Approach		**346**	**2.9**	**0.165**	**0.7**	**LOS A**		**0.00**	**0.06**	**58.3**
Coast Road North										
11	T	316	2.9	0.165	0.0	LOS A	0	0.00	0.00	60.0
12	R	29	0.0	0.058	14.5	LOS B	2	0.51	0.78	34.1
Approach		**344**	**2.6**	**0.165**	**1.2**	**LOS A**	**2**	**0.04**	**0.07**	**56.3**
All Vehicles		**752**	**2.8**	**0.165**	**1.9**	**Not Applicable**	**3**	**0.06**	**0.12**	**54.6**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

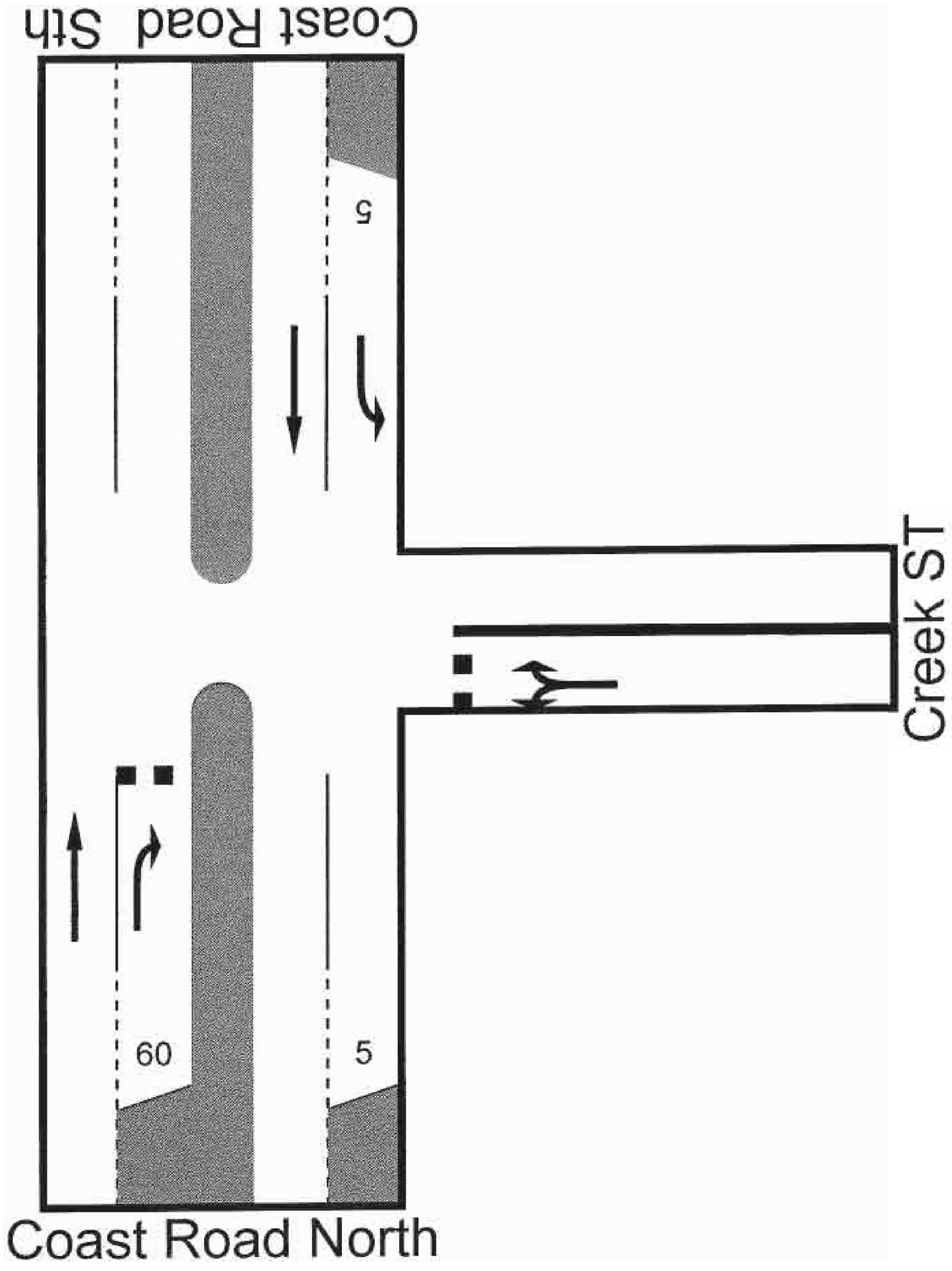
Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: Coast Rd -Creek ST
G:\Jobs\SIDRA\206012\206012-Palm Lakes works-Hasings point.aap
Processed Mar 30, 2008 05:59:58PM

A1733, Opus Qantec McWilliam, Small Office


Coast Road Sth
5
Creek ST
60
5
Coast Road North

APPENDIX G

Soil Surveys Geotechnical Assessment

SOIL SURVEYS

PROJECT NO. 204-4808

JULY, 2004

WALTER ELLIOTT HOLDINGS PTY LTD

PROPOSED FILLING

LOT 156 CREEK STREET
HASTINGS POINT

Soil Surveys Engineering Pty Limited
Specialists in Applied Geotechnics
A.B.N. 70 054 043 631
www.soilsurveys.com.au

SOIL SURVEYS

Directors

PJ Dixon BE(Hons) RPEQ
PR Cosh BE(Civil) CPEng MIE Aust RPEQ
NT Perkins BAppSc(AppGeol) BEng(Hons1)
MV Geale BEng(Civil) MBA CPEng MIE Aust RPEQ
GEJ Gray

Associates

P Elkington BE(Civil)
AM Rutten BE(Hons1) MEngSc LGE CPEng MIE Aust RPEQ
SL Gamble BE(Geol) CPEng MIE Aust RPEQ

Gold Coast Office
Job No: 204-4808
REF: 2-4808BR
Author: Patrick Kidd

27 July, 2004

Walter Elliott Holdings Pty Ltd
C/- Blueland Engineers
PO Box 6389
TWEED HEADS NSW 2486

ATTENTION: MR MARTIN FINDLATER

Dear Sir,

RE: GEOTECHNICAL INVESTIGATION - PROPOSED FILLING- LOT156 CREEK STREET, HASTINGS POINT

Enclosed is a revised copy of our report for the above project dated July 2004. Three copies of the report have been issued.

Authority to proceed with the investigation was dated 2nd June, 2004.

Should you have any queries regarding this report, please do not hesitate to contact Patrick Kidd or Albert Rutten at our Gold Coast Office.

Yours faithfully,

A. M. RUTTEN (RPEQ 2202)

for and on behalf of
SOIL SURVEYS ENGINEERING PTY LIMITED

Brisbane
Level 2, 19 Finchley Street
Milton Qld
PO Box 317
Paddington Qld 4064
Australia
Ph 617 3369 6000
Fax 617 3369 6660
brisbane@soilsurveys.com.au

Gold Coast
Unit 9, 39 Lawrence Drive
Nerang Qld
PO Box 2743
Nerang Qld 4211
Australia
Ph 617 5596 1528
Fax 617 5578 3916
goldcoast@soilsurveys.com.au

Sunshine Coast
11 Production Avenue
Kawana Waters Qld
PO Box 2
Buddina Qld 4575
Australia
Ph 617 5493 1980
Fax 617 5493 2837
sunshinecoast@soilsurveys.com.au

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APPENDICES

A **Notes Relating to this Report**

B **Borehole Records including Dynamic Cone Penetrometer Test Results**

C **Cone Penetrometer Tests**

D **Site Plan**

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation carried out by Soil Surveys Engineering Pty Limited between 8th and 23rd June 2004, for the proposed filling at Creek Street, Hastings Point.

The investigation was carried out at the request of Walter Elliott Holdings Pty Ltd.

The objectives of this investigation were to assess subsurface conditions at the site in accordance with the Scope of Services detailed in Section 2.0.

Acid sulfate sampling and contamination sampling and testing was also undertaken concurrently with the geotechnical investigation and these results have been provided in a factual report.

2.0 SCOPE OF GEOTECHNICAL SERVICES

The scope of geotechnical services provided by Soil Surveys Engineering Pty Limited was directed towards evaluating the following items as detailed in our proposal 204-4808 dated 19th May, 2004.

- The nature and type of subsurface material noting depth and condition of soils.
- Earthwork recommendations
- Foundation recommendations
- Construction recommendations (where applicable)
- Predicted settlements
- Site management recommendations

3.0 PROPOSED DEVELOPMENT

It is understood the proposed development will consist of up to two metres of filling being placed on the site probably followed by the site being developed as a residential development.

4.0 GEOTECHNICAL INVESTIGATION

4.1 Field Investigation

Subsurface conditions were investigated by the following field work:-

- Drilling 16 boreholes, to depths of 2 to 6m using a 4WD mounted Jacro 105 drilling rig. Boreholes 1 to 6 were augmented by Dynamic Cone Penetrometer (DCP's) tests adjacent the boreholes.
- Performing 8 Cone Penetrometer Tests (CPT's) to depths of between 3.3m and 10.7m, using a 4WD mounted Gemco HP7 drilling rig.

The soil classification descriptions and field testing were carried out in general accordance with Australian Standards.

AS.1726 - 1993	Geotechnical Site Investigations
AS.1289	Methods of Testing Soils for Engineering Purposes

Notes relating to this report, borehole records, CPT results and a site plan showing the location of the boreholes, are included in the Appendices.

4.2 Site Description

The site of the proposed development is located to the west of the town of Hastings Point, on the southern side of Creek Street. The site is bounded by a creek to the east, west and south and by residential properties and Creek Street to the north.

At the time of the investigation, the site was occupied by a caravan in the central northern portion of the site, elsewhere the site was clear of existing structures. Vegetation generally consisted of low height grass cover with scattered trees around the edges of the site with some small clumps of trees also towards the edges of the site. A drain is present on the site flowing from south to north in the western end of the site. The banks of the drain are lined with Melaleuca trees.

At the time of the investigation the site was being used to graze horses. Access to the site is via a gate off Creek Street.

5.0 GEOTECHNICAL MODEL

5.1 Subsurface Profile

It is understood the site may have been mined in the past.

Sand backfilling utilised after the mining operation appears to be the same as the natural sand material encountered across the site, and in this case it was difficult to distinguish natural materials from fill.

Generally a full sand subsurface profile was encountered across the site with only occasional clayey sand and very occasional silty clay interbeds.

The sands encountered were typically loose to medium dense with some very loose to loose and soft bands typically where the clayey sands and silty clays interbeds were encountered. Some dense indurated sands were encountered on the site in boreholes 4,5 and 6 and in CPT 5.

The encountered subsurface profiles are presented in borehole, CPT and DCP records in the Appendices.

5.2 Groundwater

Groundwater was noted in most boreholes across the development, at depths of between 0.1m and 1.55m, but was not encountered in BH16.

Typically the standing groundwater level in coastal areas is expected to be at about RL0.5m with fluctuations of ±0.5m under normal conditions (non-flood). Rises in groundwater to RL1.5 to RL2.0 (AHD) have been recorded in the Gold Coast area under heavy and prolonged rainfall (flood conditions) and similar rises in groundwater level could well be expected in this coastal area. Groundwater levels may fluctuate with climatic conditions and may show a damped response with tidal variations close to the adjacent to Creek

Table 1 presents a summary of the groundwater intersection levels.

TABLE 1

Borehole	Groundwater Depths Below the Existing Ground Surface Level.	
	Water First Noted	Steady Water Level
1	1.05	0.9
2	1.25	1.3
3	1.3	1.85
4	0.3	0.55
5	0.7	0.8
6	0.1	0.6
7	0.1	0.6
8	0.75	0.7
9	0.95	1.0
10	0.9	0.9
11	1.1	1.0
12	1.55	1.5
13	1.55	1.0
14	0.85	0.9
15	1.5	1.4
16	NE	NE

NE = Not Encountered

6.0 ENGINEERING ASSESSMENT

6.1 Traffickability and Site Preparation

At the time of the field investigation, some problems with traffickability were encountered in the low lying areas towards the north western area of the site and along the edges of the site adjoining the creek, where water was ponding.

Problems with traffickability could arise across the site following disturbance of the upper soil layers and as a result of removal of vegetation, ie. grass and tree roots etc. No major problems are envisaged with the use of tracked equipment. Once surface vegetation has been stripped, traffickability for wheeled equipment is expected to be difficult without use of prepared tracks.

The contractors should fully inform themselves of the ground conditions on site prior to commencement of earthworks. This requirement should be explicit in any earthworks specifications or contract.

6.2 Earthworks

It is understood that filling of the site to depths of up to 2m is proposed.

Earthwork procedures should be carried out in a responsible manner in accordance with AS.3798-1996 "Guidelines on Earthworks for Commercial and Residential Developments".

Earthwork procedures should include the following:-

- Clearing, stripping and grubbing should be carried out in areas subject to earthworks. Also all soils containing organic matter should be stripped from the construction area. This material is not considered suitable for use as structural fill. Depth to the base of the root zone (stripping depth) was observed to be approximately 100 to 200mm. However, it is envisaged that thicker layers may be encountered in the lower lying areas of the site.

- Existing sloping ground, etc. should be benched to "key in" fill material and optimise compaction. Benches of sufficient width to accommodate the roller may need to be adopted in some situations. Figure 2 refers.

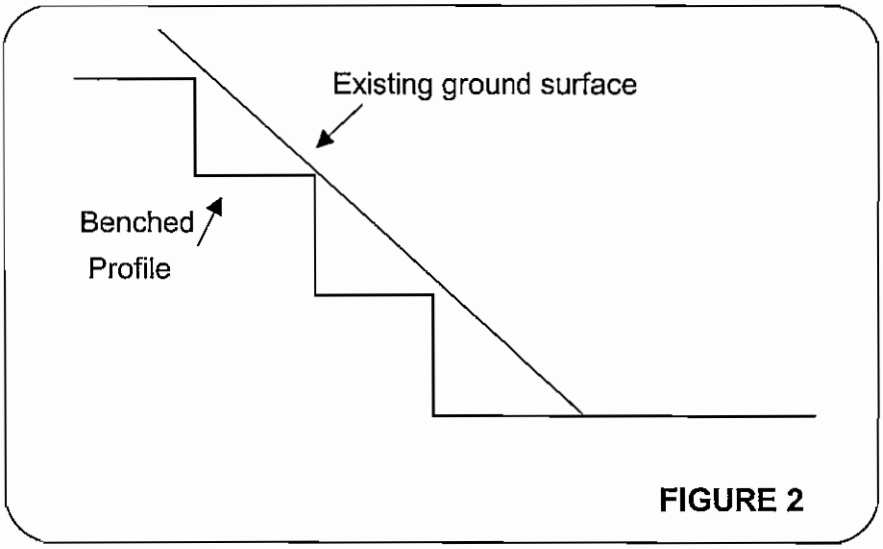


FIGURE 2

- Depressions formed by the removal of vegetation, underground elements etc. should have all disturbed weakened soil cleaned out and be backfilled with compacted select material in a controlled manner.
- In areas where fill is to be placed, the existing ground surface should be proof rolled under the supervision of an experienced geotechnical engineer to detect any soft or loose material and to compact the surficial sands. Soft/Loose soils, particularly soft clays and loose surface clayey sands, should preferably be removed. In areas of cut, proof rolling shall be deferred until after the cut operation and sufficient compaction should be achieved. The insitu soils, where free of organic and deleterious material, may be used for structural fill. Mimimal difficulties are envisaged to be encountered in compacting the clean sands encountered in the higher level areas of the site, using conventional earthworks techniques.
- Guidelines for minimum relative compaction values for insitu soils and imported fill for the building and pavements are presented in Table 3 below.

TABLE 3 MINIMUM RELATIVE COMPACTION

Location	Minimum Density Index (%)
Building Areas - residential houses	65%
Pavement Area	
a) >0.3m below pavement subgrade	65
b) ≤0.3m below pavement subgrade	75

- Field density testing in the form of Dynamic Cone Penetrometer tests should be carried out to check the standard of compaction achieved. The frequency and extent of testing should be as per guidelines in AS.3798-1996, Section 8.0.
- Backfilling for service trenches, etc. should use good quality clean sand material. The backfill should be placed in uniform layers over the full width of the excavations with the layers not exceeding 200mm loose thickness. The backfill material should be compacted to the specifications outlined above. Testing to confirm that the required degree of compaction has been achieved should be undertaken during the backfilling operation.
- Most soils encountered on site should be within the excavation limits of a small dozer (eg. Cat D4 or similar) in bulk earthworks and a medium sized backhoe (eg. Case 580 or similar) in trench excavations.

Batters

Considering the proposed maximum height of cut and fill, maximum batter angles of 18° (1V:3H) long term, and 30° short term are recommended. Steeper batters are possible by use of retaining structures. Fill batter slopes are dependent on suitable compaction being achieved.

All fill batters should be overfilled and trimmed back to design profile, no steeper than 1V:2H, to ensure compaction is achieved.

It is essential that batters be suitably protected from erosion and scour by the establishment of ground cover and shrubs, installation of surface drains, etc. Runoff should not be allowed to discharge directly across the batters.

Earthworks Supervision

Given the nature of the earthworks operation, "engineering supervision" of the earthworks operation is recommended.

It is recommended that the following "objectives" (as a minimum) are incorporated into the earthworks specification:-

- Certification that all general earthworks operations (ie. stripping, proof rolling of subgrade, etc.) have been carried out in accordance with the earthworks specification.
- Certification that fill has been placed and compacted to the required minimum density in accordance with the earthworks specification.
- Certification that the quality of any fill complies with the earthworks specification requirements.

It is recommended that all "certification" be signed off by an RPEQ or CPENG.

6.3 *Broadscale Foundation Recommendations*

6.3.1 *General*

It is understood that the likely proposed development is to generally consist of a typical residential development, with buildings up to two storeys. In the areas of typical residential construction up to two storeys, where fill is to be placed, the existing surface after stripping should be proof rolled as delineated in Section 6.2.

6.3.2 *Residential Type Development*

It is considered likely that provided suitable control of the bulk earthworks operation is undertaken, in accordance with the recommendations outlined in Sections 6.1 and 6.2, the development site will be suitable for the use of high level footings for the support of residential type structures.

Some recompaction of the footings etc. may be required at the time of excavation.

Suitable control of the Earthworks

Suitable control of the earthworks would include the steps outlined in the procedure below :-

i) Strip unsuitable material from the site.

ii) Water and compact the stripped surface using a smooth drum roller, ensuring minimum of 65% density index to generally at least 0.5m below the base of the stripped surface.

iii) Place 'clean' sands and compact in layers to achieve a minimum density index of 65% (AS.1289 - 5.5.1/5.6.1) to the proposed fill level.

iv) Note: The layer thickness that can be used will depend on whether a static or vibrating roller is used. Increased thickness is possible with a vibrating roller. The topsoil layer or sands containing significant organic matter, or more than 5% silt and clay fines, or building rubble are not recommended for use as fill. An assessment of the sands is recommended prior to placement and recompaction.

v) Testing of the stripped surface and subsequent fill layers is recommended in accordance with guidelines detailed in AS.3798-1996 'Guidelines on Earthworks for Commercial and Residential Developments'.

vi) Test method AS.1289 6.3.2 'Determination of Penetration Resistance of a soil using the 9kg Dynamic Cone Penetrometer' is recommended to verify compaction using accepted density index correlation tables.

The base of all pad and strip footings should be individually recompacted using a vibrating plate compactor prior to placement of reinforcing steel and concrete as soils may be loosened during the excavation process by machinery action. If the sand is dry, it should be saturated and left for a short period prior to vibration. Should any loose areas be encountered in the footing excavations the density of these areas must be improved. Further testing by means of dynamic cone penetrometer tests should be carried out to confirm the adequacy of the founding soils.

Average settlements in the improved sands beneath a pad footing of 1.0m width at a nominal founding depth below existing ground level and a design bearing pressure of 150kPa are estimated to be in the order of less than 25mm with anticipated differential settlements of between 25% and 50% of the calculated total settlement for adjacent pad footings founded at a similar depth. These calculations assume adequate densification of the founding sands.

This settlement will occur as immediate settlement as the construction loads are applied.

Indicative site classifications of Class 'M' are likely to result for typical residential structures, subject to individual site investigations being carried out site specific for each site/structure.

Ancillary Structures

Non structural elements such as masonry fences, garden walls etc. should be founded at least 400mm below finished ground level. It is recommended that the subsoil to at least 0.6m below the footings of ancillary structures be compacted to at least 65% Density Index. An allowable bearing pressure of 150kPa may then be adopted for design.

All ancillary structures including fences should be suitably articulated to cater for any potential differential movement.

Excavation Stability

The following general recommendations are made for short term stability of batters for bulk excavation of the proposed development if required.

For Excavation Less Than 2.0 metres Depth

- Batter angle not greater than 1V:1.5H from horizontal.
- Top of batter to be a minimum of 3.0 metres away from any building or movement sensitive structures.

For Excavation Greater Than 2.0 metres Depth

- Batter angle not greater than 1V:1.5H from horizontal
- Top of batter to be a minimum of 2.0 metres inside any boundary line, in addition to 3.0 metres distance from any building or structure.

Note: If batters are to be left untreated for any length of time a batter angle of 1V:2H is recommended and berm widths are to be strictly maintained.

7.0 CONSTRUCTION INSPECTIONS

Inspection and testing of the bulk earthworks should be carried out by Soil Surveys Engineering Pty Limited or a duly qualified and experienced Geotechnical Engineer. Should subsurface conditions other than those described in this report be encountered, Soil Surveys Engineering Pty Limited should be consulted immediately and appropriate modifications developed and implemented if necessary.

8.0 LIMITATIONS

We have prepared this report for the use of **WALTER ELLIOTT HOLDINGS PTY LTD** for design purposes in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has not been prepared for use by parties other than **WALTER ELLIOTT HOLDINGS PTY LTD** or their associated design consultants, ie. Architect and Civil/Structural Engineers. It may not contain sufficient information for purposes of other parties or for other uses.

Soil Surveys Engineering offer a documentation review service to verify that the intent of geotechnical recommendations is properly reflected in the design. It is recommended that clients avail themselves of this service; our standard rates will apply.

P. KIDD

A. M. RUTTEN (RPEQ 2202)

for and on behalf of
SOIL SURVEYS ENGINEERING PTY LIMITED

APPENDICES

APPENDIX A

NOTES RELATING TO THIS REPORT

INTRODUCTION

These notes are provided by Soil Surveys Engineering Pty Limited (the Company) to complement the geotechnical report in regard to classification methods and field procedures. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and at the time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

Soils - The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726-1993 (Geotechnical Site Investigations), where appropriate. In general, descriptions cover the following properties - soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the dominant particle size and behaviour as set out in AS 1726-1993.

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, shear vane, laboratory testing or engineering examination. The strength terms are defined in AS1726-1993 Table A4.

Non-cohesive soils are classified on the basis of relative density usually based on insitu testing or engineering examination (see AS1726-1993 Table A5).

Rocks - Rock types are classified by their geological names (AS1726-1993 Table A6), together with descriptive terms regarding weathering (AS1726-1993 Table A9), strength (refer Table 1 below), defects (AS1726-1993 Table A10), etc. Where strength testing (ie Point Loads) is carried out, AS1726-1993 Table A8 is used. Where relevant, further information regarding rock classification is attached.

Table 1 Estimated strength descriptions given to rock based on engineering examination

Strength Term	Approximate Qu (MPa)
Extremely Weak	< 1.0
Very Weak	1.0 - 5.0
Weak	5.0 - 25
Medium Strong	25 - 50
Strong	50 - 100
Very Strong	100 - 250
Extremely Strong	> 250

Ref ISRM "Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses"

SAMPLING

Sampling is carried out during drilling or from other excavations to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon sample disturbance, (information on strength and structure).

Undisturbed samples are taken by pushing a thin walled sample tube, usually 50mm diameter (U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength, volume change potential and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application.

Test Pits - These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling - A borehole of 50 to 100mm diameter is advanced by manually operated equipment. Refusal of the augers can occur on a variety of materials such as hard clay, gravel or rock fragments and does not necessarily indicate rock level.

Continuous Spiral Flight Augers - The borehole is advanced using 75 to 300 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the augers. Information from the drilling (as distinct from specific sampling) is of relatively lower reliability due to remoulding, inclusion of cuttings from above or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table has a lower reliability than augering above the water table. Various drill bits are attached to the base of the augers during the drilling. The depth of refusal of the different bit types can provide information as to the strength of the material encountered. Generally two different bit types are used. The 'V' bit is a V shaped steel bit and the 'TC' bit is a tungsten carbide tipped screw type bit.

Wash Boring - The borehole is usually advanced by a rotary bit with water or fluid pumped down the hollow drill rods and returned up in the space between the rods and the soil or casing, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration. More accurate information on soil strata is gained by regular testing and sampling using the Standard Penetration Test (SPT) and undisturbed thin walled tube samples (U50).

Mud Stabilized Drilling - Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilize the borehole. The term "mud" encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from regular intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling - A continuous core sample is obtained using a diamond or tungsten carbide tipped core barrel. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable method of investigation. In rocks, NMLC coring (nominal 52 mm diameter) is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The location of losses is determined on site by the supervisor. If the location of the loss is uncertain, it is placed at the top end of the run, when the core is placed in a storage tray and recorded on the log.

Standard Penetration Tests - Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" - Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm, the upper 150 mm being neglected due to possible disturbance from the drilling method. In dense sands, very hard clays or weak rock, the full 450 mm

penetration may not be practicable and the test is discontinued at a reduced penetration.

In the case where full penetration is obtained with successive blow counts for each 150 mm of, say 4, 6 and 7 blows, the record shows,

4, 6, 7 N = 13

In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm, the record shows:

15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, it is noted on the borehole logs.

A modification to the SPT test is where the same driving system is used with a solid 60^0 tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid SPT are shown as "N_c" on the borehole logs, together with the number of blows per 150 mm penetration.

Cone Penetration Tests - Test Method - Cone Penetration Tests (CPT) are carried out in accordance with AS 1289 Test 6.5.1-1977, using an electrical friction-cone penetrometer.

The test essentially comprises the measurement of resistance to penetration of a cone of 35.7 mm diameter pushed into the soil at a rate of 10-20 mm per second by hydraulic force. The resistance to penetration is recorded in terms of pressure on the end area of the cone (cone resistance, q_c, in MPa) and friction on the side of the 135 mm long sleeve immediately above the top of the cone (friction resistance, f_s, in kPa). These forces are measured by electrical transducers (strain gauges) within the cone device. The ratio between friction resistance and cone resistance is also calculated as a percentage, ie.-

$$\textit{Friction Ratio } (FR) = \frac{\textit{Friction Resistance}, f_s\ (kPa) \times 100}{\textit{cone resistance}, q_c\ (kPa)}$$

The friction ratio, FR, is generally low in sands (less than 1% or 2%) and generally higher in clays (say 3% or more). The interpretation of sandy clays, clayey sands and material with a high silt content is more difficult, but intermediate values (between 1% and 3%) would be expected. Highly organic clays and peats generally have a friction ratio in excess of 5%.

Static cone data is recorded in the field on disc for later presentation using computer aided drafting.

The equipment can be operated from any conventional drill rig. A total applied load in the range of 4 to 10 tonnes is required for practical purposes, although lighter loads may be used. The cone penetrometers are available with various capacities of cone resistance ranging up to 100 MPa for general purpose investigations, while a range of 0 to 10 MPa can be used where more sensitive investigations of soft clay are required.

The cone resistance value provides a continuous measure of soil strength or density, and together with the friction ratio, provide very useful indications of the presence of narrow bands of geotechnically significant layers such as thin, soft clay layers or lenses of sand which might otherwise be missed using conventional drilling methods.

The lithology of the encountered soils is interpreted from static cone data and is generally presented on the static cone log sheets.

It is important to note that the lithology is interpreted information and is based on research by Schmertmann (1970), Sanglerat (1972), Robinson and Campinalli (1986), modified to suit local conditions as indicated by borehole information and laboratory testing.

As soils generally change gradually it is sometimes difficult to accurately describe depths of strata changes, although greater accuracy is obtained with the static cone compared with conventional drilling. In addition, friction ratios decrease in accuracy with low cone resistance values, and in desiccated soils. As a result, some overlap and minor discrepancies may exist between static cone and nearby borehole information.

Portable Dynamic Cone Penetrometers - Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 100mm increments of penetration.

The DCP comprises a Cone of 20 mm diameter with 30 degree taper attached to steel rods of smaller section.

The cone end is driven with a 9 kg hammer falling 510 mm (AS. 1289 Test 6.3.2). The test was developed initially for pavement subgrade investigations, and empirical correlations of the test results with California Bearing Ratio have been published by various Road Authorities. The Company has developed their own correlations with Standard Penetration tests and Density Index tests in sands.

LOGS

The borehole or test pit logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems.

- Although groundwater may be present in lower permeability soils, it may enter the hole slowly or perhaps not at all during the time the hole is open.
- A localized perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be bailed out of the bore and mud must be washed out of the hole or "reverted" if water observations are to be made.

More reliable measurements can be made by use of standpipes which are read after stabilizing at periods ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc.) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is important to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms and the attached explanatory notes summarize important aspects of the Laboratory Test Procedures adopted.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal the information and interpretation may not be relevant if the design proposal is changed. If this happens, the Company

will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. Since the test sites in any exploration represent a very small proportion of the total site and since the exploration only identifies actual ground conditions at the test sites, even under the best circumstances actual conditions may vary from those inferred to exist. No responsibility is taken for:-

- Unexpected variations in ground and/or groundwater conditions.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of other persons.
- Any work where the company is not given the opportunity to supervise the construction using the Companies designs/recommendations.

If differences occur, the Company will be pleased to assist with investigation or advice to resolve any problems occurring.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are more readily resolved when conditions are exposed than at some later stage, well after the event.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances, where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

REVIEW OF DESIGN

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/ constraints are quite complex, it is prudent to have a joint design review which involves a senior geotechnical engineer. We would be happy to assist in this regard as an extension of our investigation commission.

SITE INSPECTION

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

i) Site visits during construction to confirm reported ground conditions

ii) Site visits to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, the stability of a filled or excavated slope; or

iii) Full-time engineering presence on site.

In the vast majority of cases it is advantageous to the principal for the geotechnical engineer who wrote the investigation report to be involved in the construction stage of the project.

APPENDIX B

BOREHOLE RECORDS INCLUDING DYNAMIC CONE PENETROMETER TEST RESULTS

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQG No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4578, PO Box 2, Buddina Q 4578, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 1

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004 Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V, TC, WB, RR, NMLC, Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.30		FILL SAND (SP) Loose, fine to medium grained, grey, moist.		D
			FILL SAND (SP) Loose to medium dense, fine to medium grained, grey-brown, some silt fines, moist.		D
	1.0 ▼ ▽ 1.05				D
			NATURAL Silty SAND (SM) Loose, fine to medium grained, dark brown, wet.		D
	1.80				
	2.0		SAND (SP) Medium dense, fine to medium grained, grey, wet.		
	3.0				
	4.0				
	5.0				
	5.60				
	6.0 6.00		Silty SAND (SM) Medium dense, fine to medium grained, grey, wet.		
			Borehole Terminated 6.00m		
	7.0				
	8.0				
	9.0				
	10.0				

COMMENTS

1) Groundwater noted at 1.05m. 2) Steady water noted at 0.9m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Elliott

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1526, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4578, PO Box 2, Buddina Q 4578, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 2
Project Number : 204-4808

Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004

Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V, TC, WB, RR, NMLC, Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.25		FILL Silty SAND (SM) Very loose to loose, fine to medium grained, dark grey, moist.		D
	0.80		FILL SAND (SP) Loose, fine to medium grained, grey, some silt fines, moist.		D
	1.0		FILL Silty SAND (SM) Loose, fine to medium grained, dark brown, moist.		D
	▼ ▽ 1.25		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark brown, organic matter, wet.		D
	1.65		SAND (SP) Medium dense, fine to medium grained, grey, wet.		
	2.0				
	3.0				
	4.0				
	5.0				
	5.50		Silty SAND (SM) Medium dense, fine to medium grained, grey, wet.		
	6.0				
	6.00		Borehole Terminated 6.00m		
	7.0				
	8.0				
	9.0				
	10.0				

COMMENTS

1) Groundwater noted at 1.25m. 2) Steady water noted at 1.3m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Forbes
Date : 27 7 04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPECQ No. 195
A.C.N. 054 043 531
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 8 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4578, PO Box 2, Buddina Q 4578, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 3
Project Number : 204-4808

Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004 Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method: V, TC, WB, RR, NMLC, Casing

Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
0.15		FILL Silty SAND (SM) Loose, fine to medium grained, grey-brown, moist		D
		FILL SAND (SP) Medium dense, fine to medium grained, light grey bleached brown, moist.		D
1.0				D
1.30 ▼				
1.70 ▽		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark brown, some organic matter, wet.		D
2.0		SAND (SP) Medium dense to dense, fine to medium grained, grey-brown, some silt fines, wet.		
3.0				
4.0				
5.0				
6.0				
6.00		Borehole Terminated 6.00m		
7.0				
8.0				
9.0				
10.0				

COMMENTS
1) Groundwater noted at 1.3m. 2) Steady water noted at 1.85m.

▼ Water First Noted ▽ Water Steady Level

Approved : Sam Sutton
Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au

Level 2 19 Finchley Street
Milton Q 4064
PO Box 317
Paddington Q 4064
Ph 61 7 3369 6000
Fax 61 7 3369 6660

Unit 9 39 Lawrence Dr
Nerang Q 4211
PO Box 2011
Nerang Q 4211
Ph 61 7 5596 1528
Fax 61 7 5578 3916

11 Production Ave
Kawana Waters Q 4578
PO Box 2
Buddina Q 4578
Ph 61 7 5493 1733
Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 4

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.30		NATURAL Silty SAND (SM) Very loose to loose, fine to medium grained, grey-brown, organic matter, moist.		D
	1.00		Silty SAND (SM) Loose, fine to medium grained, grey-brown, trace of organic, moist.		D
	3.30		SAND (SP) Medium dense, fine to medium grained, grey, wet.		D
	6.00		Silty SAND (SM) Dense to very dense, fine to medium grained, dark grey-brown, wet.		D
			Borehole Terminated 6.00m		

COMMENTS

1) Groundwater noted at 0.3m. 2) Steady water noted at 0.55m. 3) DCP Refusal at 3.6m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Tustin

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4578, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 5

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V, TC, WB, RR, NMLC, Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.15		FILL Silty SAND (SM) Loose, fine to medium grained, grey-brown, moist.		D
	0.75		FILL Silty SAND (SM) Loose to medium dense, fine to medium grained, grey-brown, moist.		D
	1.10		FILL SAND (SP) Loose, fine to medium grained, grey, some silt fines, wet.		D
	1.55		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark grey-brown, wet.		D
	3.10		SAND (SP) Medium dense, fine to medium grained, grey, wet.		
	5.10		Silty SAND (SM) Very dense, fine to medium grained, dark grey-brown, wet.		
	6.00		Silty SAND (SM) Dense, fine to medium grained, grey-brown, wet.		
			Borehole Terminated 6.00m		

COMMENTS

1) Groundwater noted at 0.70m. 2) Steady water noted at 0.80m. 3) DCP Refusal at 3.2m.

▼ Water First Noted ▽ Water Steady Level

Approved : [signature]

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3368 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3918
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 6
Project Number : 204-4808
Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004
Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V, TC, WB, RR, NMLC, Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark grey-brown, some organics, moist		D
	▽		SAND (SP) Medium dense, fine to medium grained, grey, wet.		D
	1.0				D
	1.10		Silty SAND (SM) Loose, fine to medium grained, grey-brown, wet.		D
	1.90				
	2.0		Silty SAND (SM) Medium dense, fine to medium grained, grey-brown, wet.		
	2.60				
	3.0		Silty SAND (SM) Very dense, fine to medium grained, dark grey-brown, wet, (Indurated)		
	4.0				
	5.0				
	5.40				
	6.0		Silty SAND (SM) Dense, fine to medium grained, dark grey-brown, wet, (Indurated)		
	6.00		Borehole Terminated 6.00m		
	7.0				
	8.0				
	9.0				
	10.0				

COMMENTS

1) Groundwater noted at 0.1m. 2) Steady water noted at 0.6m. 3) DCP Refusal at 2.6m & 3.2m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Cutten
Date : 27 7 04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3316
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 7

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004 Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		NATURAL Organic CLAY (CO) Firm, high plasticity, dark grey-brown, organics, moist		
			SAND (SP) Loose, fine to medium grained, grey-brown, some silt fines, wet.		D
	1.0				D
					D
	2.0				D
	2.00		Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 0.1m. 2) Steady water noted at 0.6m.

▼ Water First Noted ∇ Water Steady Level

Approved : Tom Carlton

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 8
Project Number : 204-4808
Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004
Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		FILL Silty SAND (SM) Loose, fine to medium grained, dark grey-brown, moist		D
	▽ ▼ 0.75		FILL SAND (SP) Loose, fine to medium grained, grey-brown, some silt fines, moist.		D
	1.0		NATURAL Silty SAND (SM) Loose, fine to medium grained, brown bleached grey, wet.		D
	1.50		Borehole Terminated 1.50m		D
	2.0				
	3.0				
	4.0				
	5.0				

COMMENTS
1) Groundwater noted at 0.75m. 2) Steady water noted at 0.7m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Sutton
Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3915
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 9

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004 Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		FILL Silty SAND (SM) Loose, fine to medium grained, dark grey-brown, moist.		D
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, some silt fines, moist.		D
	0.90 ▽ 0.95				
	1.0		NATURAL Organic CLAY (CO) Firm, high plasticity, dark grey-brown, organics, moist.		D
			Silty SAND (SM) Loose, fine to medium grained, brown bleached grey, wet.		D
	2.0 2.00				
			Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 0.95m. 2) Steady water noted at 1.0m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tim Kelly

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 9000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 10

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		FILL Silty SAND (SM) Loose, fine to medium grained, dark gre-brown, moist.		
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.		D
	0.90				D
	1.0		NATURAL Silty SAND (SM) Medium dense, fine to medium grianed, grey-brown, wet.		D
	1.80				D
	2.0		SAND (SP) Medium dense, fine to medium grained, grey, wet.		
	2.00		Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 0.9m. 2) Steady water noted at 0.95m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Lutton

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPECQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 11

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004 Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.15		FILL Silty SAND (SM) Loose, fine to medium grained, dark gre-brown, moist.		
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.		D
	1.0 ▽ 0.95				D
	▼ 1.10		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark brown bleached grey, some organics, moist		
			SAND (SP) Medium dense, fine to medium grained, grey bleached brown, wet.		D
	2.0	2.00			D
			Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 1.1m. 2) Steady water noted at 1.0m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Lantten

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kewarra Waters Q 4578, PO Box 2, Buddina Q 4578, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 12

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V, TC, WB, RR, HMLC, Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.80		FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.		D
	1.0		FILL SAND (SP) Loose, fine to medium grained, bleached brown, moist.		D
	1.40				D
	▽ 1.55		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark brown bleached grey, some organics, moist		
	2.0		SAND (SP) Medium dense, fine to medium grained, grey bleached brown, wet.		D
	2.00		Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 1.55m. 2) Steady water noted at 1.5m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Cutten

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQQ No. 195
A.C.N. 054 043 831
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 13

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.10		FILL SAND (SP) Loose, fine to medium grained, dark grey-brown, moist.		
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.		D
	0.80		NATURAL SAND (SP) Medium dense, fine to medium grained, brown bleached grey, some silt fines, moist.		D
	1.0 ▽ ▼ 1.10		SAND (SP) Medium dense, fine to medium grained, brown bleached grey, some silt fines, wet.		D
	2.0 2.00		Borehole Terminated 2.00m		D
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 1.55m. 2) Steady water noted at 1.0m.

▼ Water First Noted ▽ Water Steady Level

Approved : [signature]

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 14
Project Number : 204-4808
Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004 Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / HMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.15		FILL SAND (SP) Loose, fine to medium grained, dark grey-brown, moist.		
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.		D
	0.85 ▽				
	1.0		NATURAL Silty SAND (SM) Loose, fine to medium grained, dark grey-brown, wet.		D
	1.40		SAND (SP) Medium dense, fine to medium grained, brown bleached grey, some silt fines, wet.		D
	2.0 2.00		Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS
1) Groundwater noted at 0.85m. 2) Steady water noted at 0.9m.

▼ Water First Noted ▽ Water Steady Level

Approved : Tom Rankin
Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQ No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6660
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kewana Waters Q 4676, PO Box 2, Buddina Q 4576, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 15

Project Number : 204-4808

Project Name : Residential Subdivision

Location : LOT 156 Creek St., Hastings Point

Client : Walter Elliott Holdings Pty Ltd

Date : 21/06/2004

Page : 1

Easting : Northing : RL :

Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	DCP Test (blows/100mm) 5 10 15 20 25	Samples and Remarks
	0.13		FILL SAND (SP) Loose, fine to medium grained, dark grey-brown, moist.		
			FILL SAND (SP) Loose, fine to medium grained, grey, moist.		D
	1.0				D
	▽ 1.40				D
	▼ 1.50		NATURAL Organics CLAY (CO) Firm, high plasticity, dark brown, moist		
			SAND (SP) Medium dense, fine to medium grained, brown bleached grey, some silt fines, wet.		D
	2.0				
	2.00		Borehole Terminated 2.00m		
	3.0				
	4.0				
	5.0				

COMMENTS

1) Groundwater noted at 1.5m. 2) Steady water noted at 1.4m.

▼ Water First Noted ▽ Water Steady Level

Approved : [signature]

Date : 27/7/04

Soil Surveys Engineering Pty. Limited
Consulting Geotechnical engineers RPEQG No. 195
A.C.N. 054 043 631
email brisbane@soilsurveys.com.au
Level 2 19 Finchley Street, Milton Q 4064, PO Box 317, Paddington Q 4064, Ph 61 7 3369 6000, Fax 61 7 3369 6680
Unit 9 39 Lawrence Dr, Nerang Q 4211, PO Box 2011, Nerang Q 4211, Ph 61 7 5596 1528, Fax 61 7 5578 3916
11 Production Ave, Kawana Waters Q 4575, PO Box 2, Buddina Q 4575, Ph 61 7 5493 1733, Fax 61 7 5493 2837

BOREHOLE RECORD SHEET

Borehole Number : 16
Project Number : 204-4808
Project Name : Residential Subdivision
Location : LOT 156 Creek St., Hastings Point
Client : Walter Elliott Holdings Pty Ltd
Date : 21/06/2004 Page : 1

Easting : Northing : RL :
Logger : RB Driller : RB Drilling Rig : Jacro105

Drilling Method (V / TC / WB / RR / NMLC / Casing)	Depth	Graphic	Description	Samples and Remarks
	0.15		FILL SAND (SP) Loose, fine to medium grained, dark grey-brown, moist.	
			FILL SAND (SP) Loose, fine to medium grained, grey-brown, moist.	D
	0.90			D
	1.0		NATURAL SAND (SP) Medium dense, fine to medium grained, brown bleached grey, some silt fines, wet.	D
	2.0			D
	2.00		Borehole Terminated 2.00m	
	3.0			
	4.0			
	5.0			

COMMENTS
1) Groundwater not observed.

Approved : Ian Walter
Date : 27/7/04

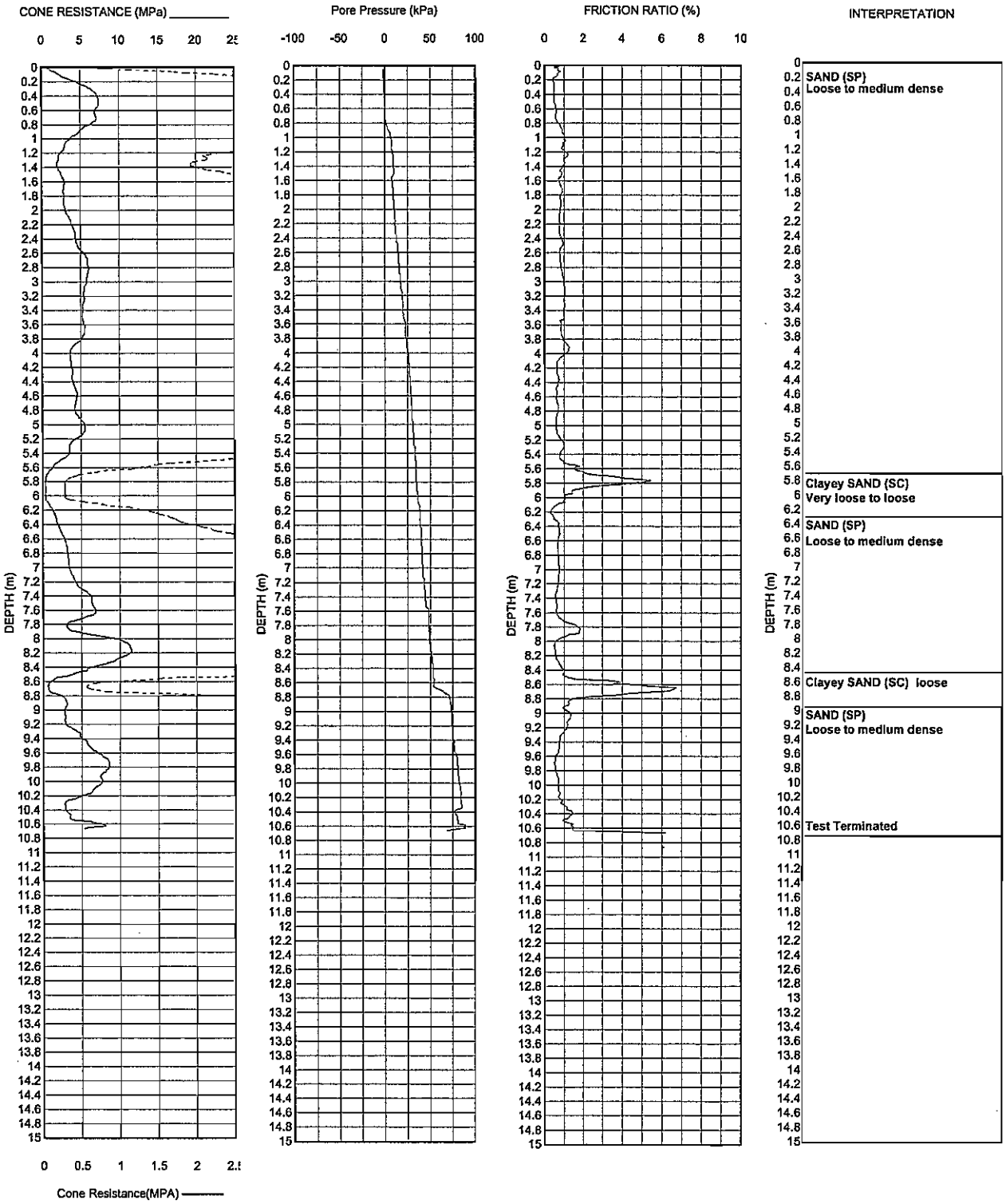
APPENDIX C

CONE PENETROMETER TEST RESULTS

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 831

JOB No	204-4808	CONE NO.	CPT 1
CLIENT	Walter Elliott Holdings	SURFACE R.L.	
PROJECT	Proposed Subdivision	CO-ORDINATES	
LOCATION	Lot 156 Creek Street, Hasting Point	DATE	08/06/2004

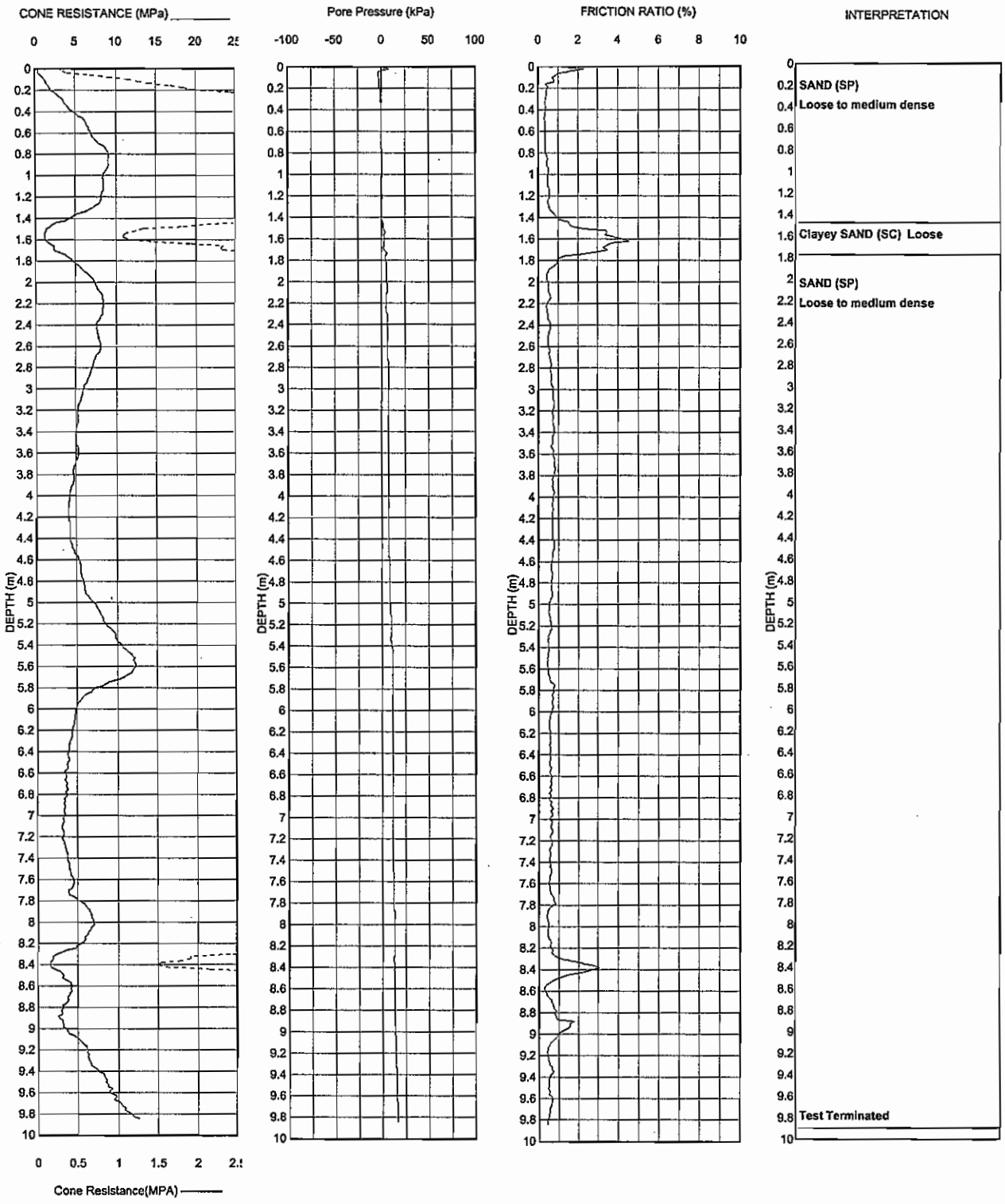


RIG	Gemco HP7	SUPERVISOR	Bob Champ
		CONE TYPE	10 sq cm Geotech (3390)

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 631

JOB No - 204-4808		CONE NO. - CPT 2	
CLIENT - Walter Elliott Holdings		SURFACE R.L. -	
PROJECT - Proposed Subdivision		CO-ORDINATES -	
LOCATION - Lot 156 Creek Street, Hasting Point		DATE - 08/06/2004	PAGE 1 OF 1

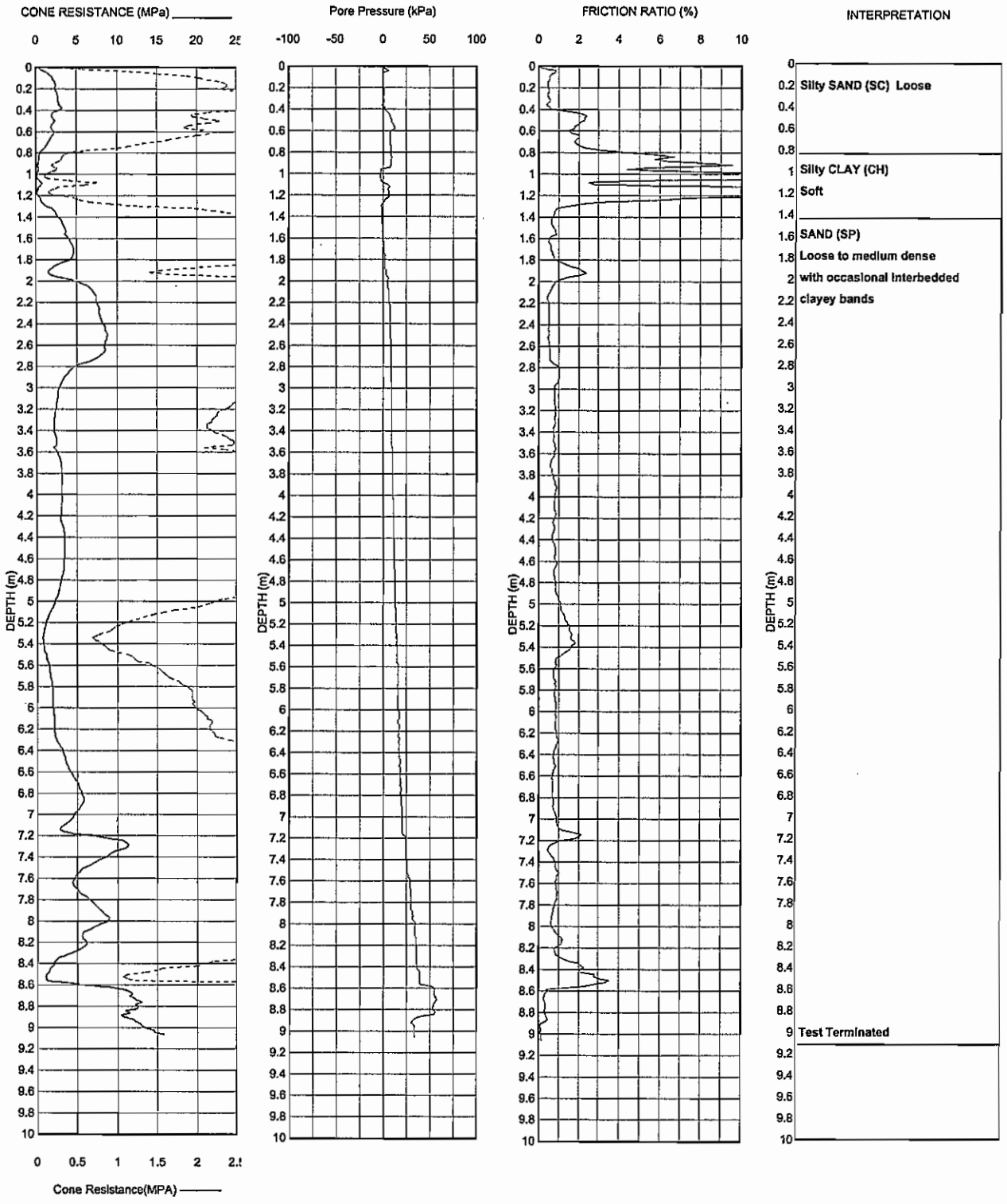


RIG - Gemco HP7		SUPERVISOR - Bob Champ	
		CONE TYPE - 10 sq cm Geotech (3390)	

Cone Penetrometer Test Record

JOB No	- 204-4808	CONE NO.	- CPT 3		
CLIENT	- Walter Elliott Holdings	SURFACE R.L.	-		
PROJECT	- Proposed Subdivision	CO-ORDINATES	-		
Soil Surveys Engineering Pty Ltd LOCATION	- Lot 156 Creek Street, Hasting Point	DATE	- 08/06/2004	PAGE 1 OF 1	

A.C.N. 054 043 631

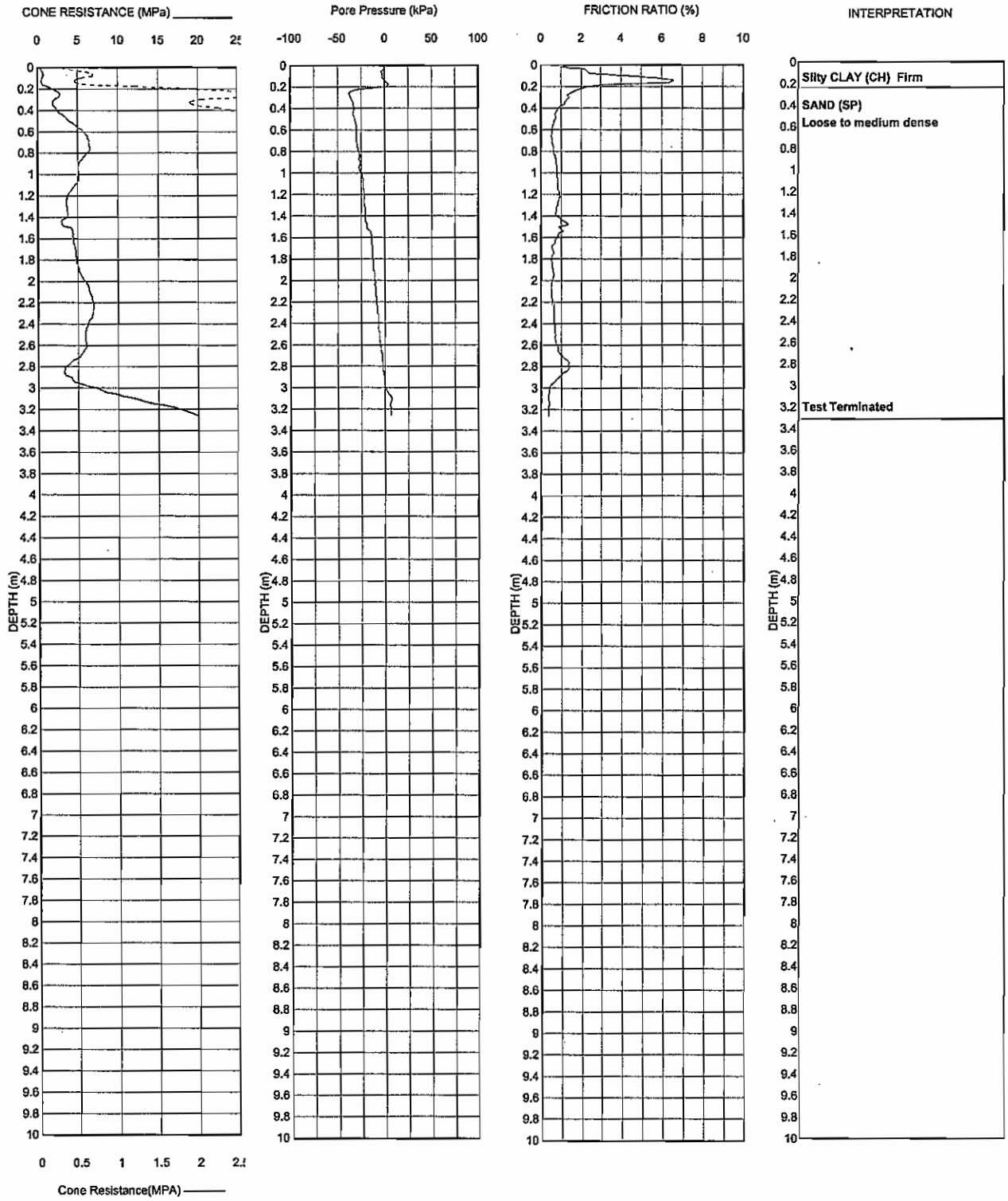


RIG	- Gemco HP7	SUPERVISOR	- Bob Champ
		CONE TYPE	- 10 sq cm Geotech (3390)

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 631

JOB No - 204-4808		CONE NO. - CPT 4	
CLIENT - Walter Elliott Holdings		SURFACE R.L. -	
PROJECT - Proposed Subdivision		CO-ORDINATES -	
LOCATION - Lot 156 Creek Street, Hasting Point		DATE - 08/06/2004	PAGE 1 0F 1

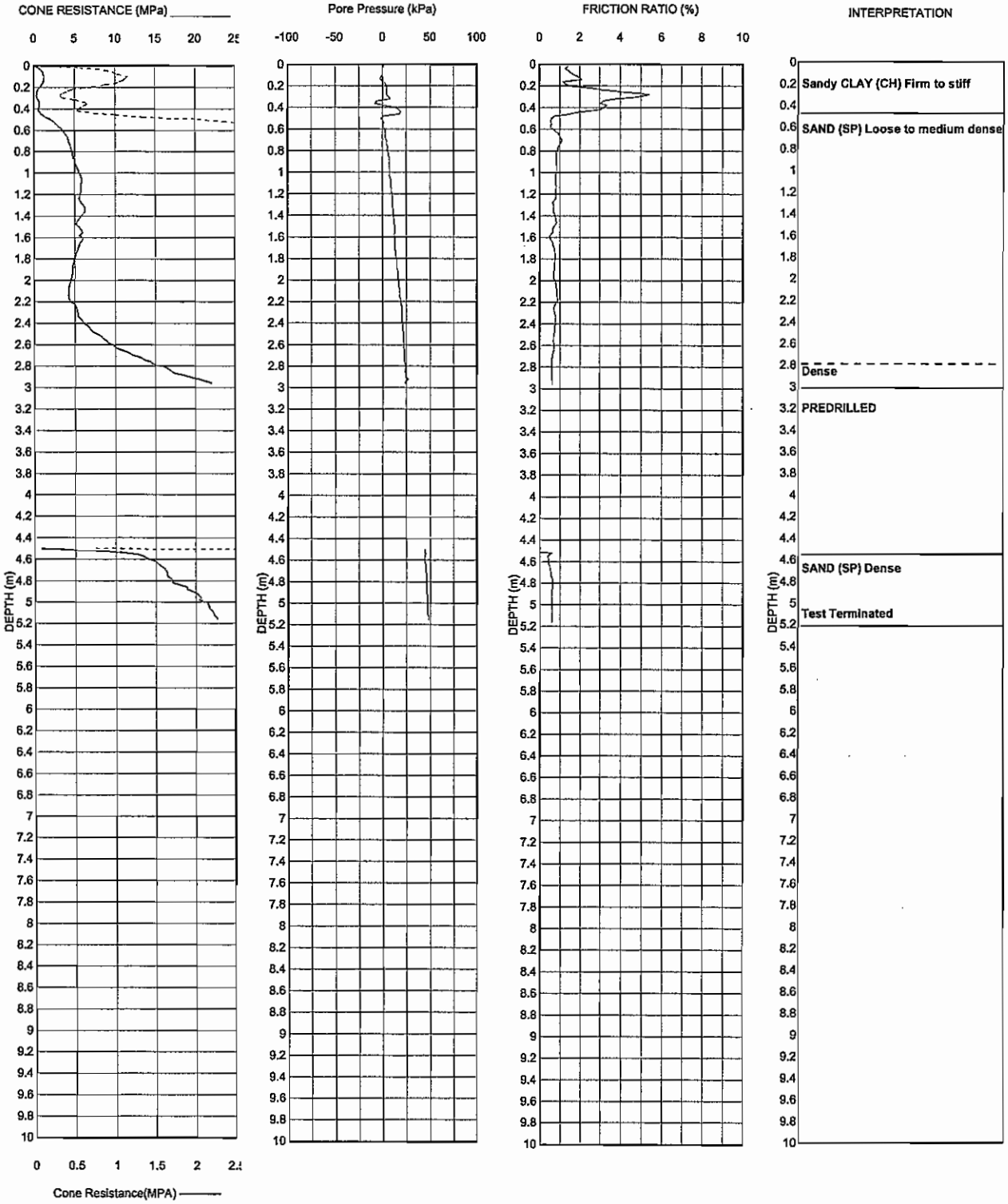


RIG - Gemco HP7		SUPERVISOR - Bob Champ	
		CONE TYPE - 10 sq cm Geotech (3390)	

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 631

JOB No	- 204-4808	CONE NO.	- CPT 5		
CLIENT	- Walter Elliott Holdings	SURFACE R.L.	-		
PROJECT	- Proposed Subdivision	CO-ORDINATES	-		
LOCATION	- Lot 156 Creek Street, Hasting Point	DATE	- 08/06/2004	PAGE 1 OF 1	

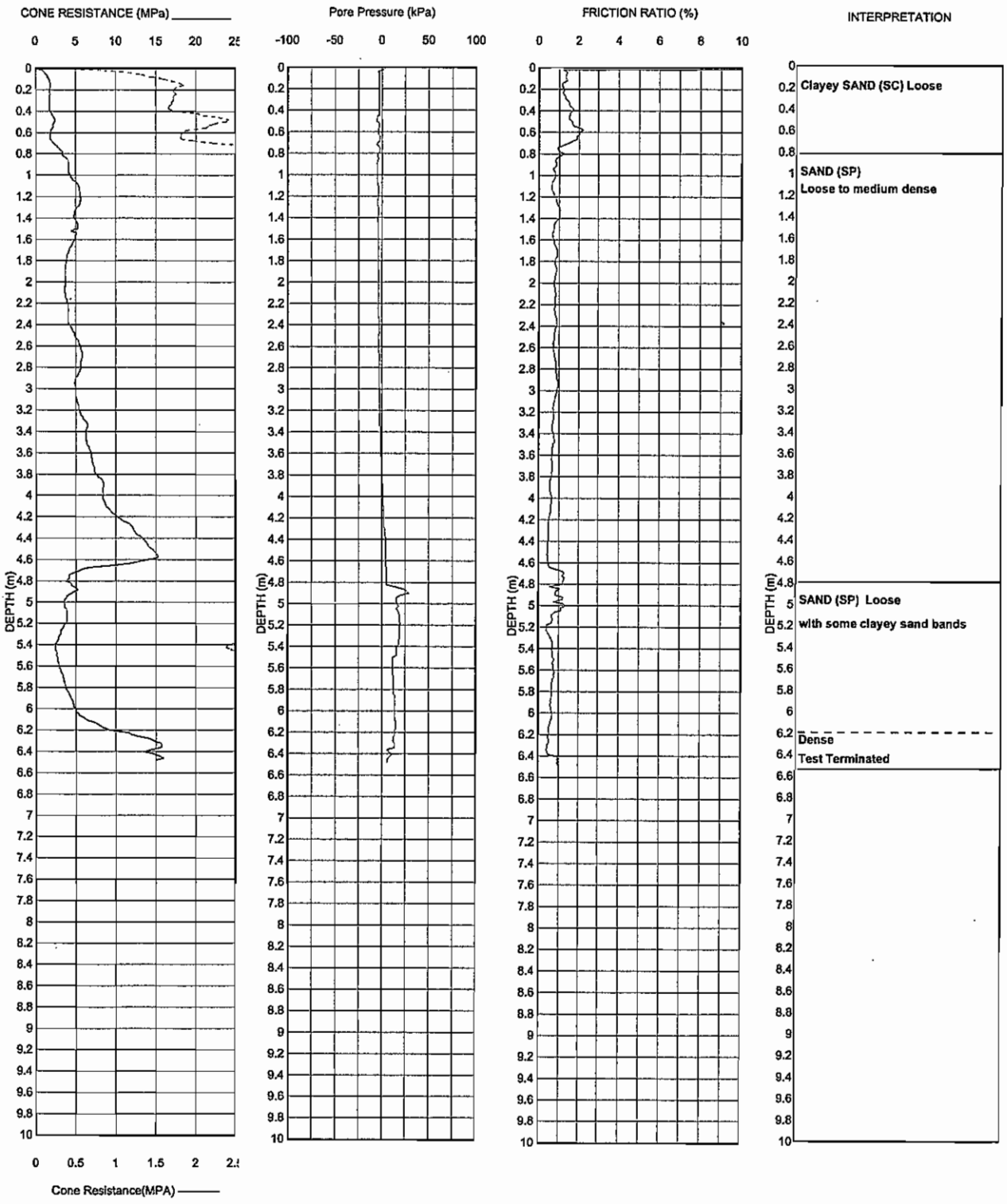


RIG	- Gemco HP7	SUPERVISOR	- Bob Champ
		CONE TYPE	- 10 sq cm Geotech (3390)

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 631

JOB No - 204-4808		CONE NO. - CPT 6	
CLIENT - Walter Elliott Holdings		SURFACE R.L. -	
PROJECT - Proposed Subdivision		CO-ORDINATES -	
LOCATION - Lot 156 Creek Street, Hasting Point		DATE - 08/06/2004	

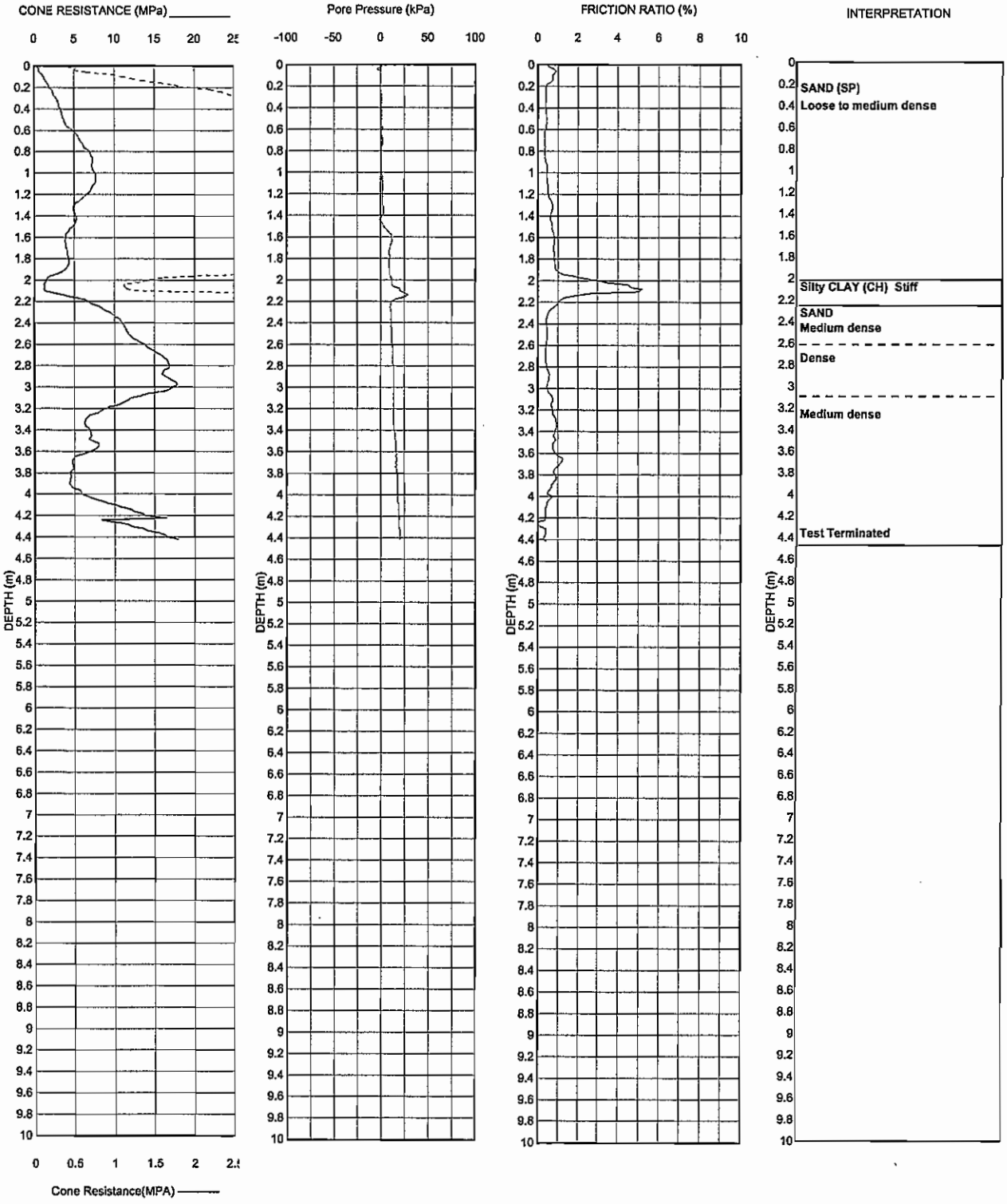


RIG - Gemco HP7		SUPERVISOR - Bob Champ	
		CONE TYPE - 10 sq cm Geotech (3390)	

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 831

JOB No	204-4808	CONE NO.	CPT 7		
CLIENT	Walter Elliott Holdings	SURFACE R.L.			
PROJECT	Proposed Subdivision	CO-ORDINATES			
LOCATION	Lot 156 Creek Street, Hasting Point	DATE	08/06/2004	PAGE 1 OF 1	

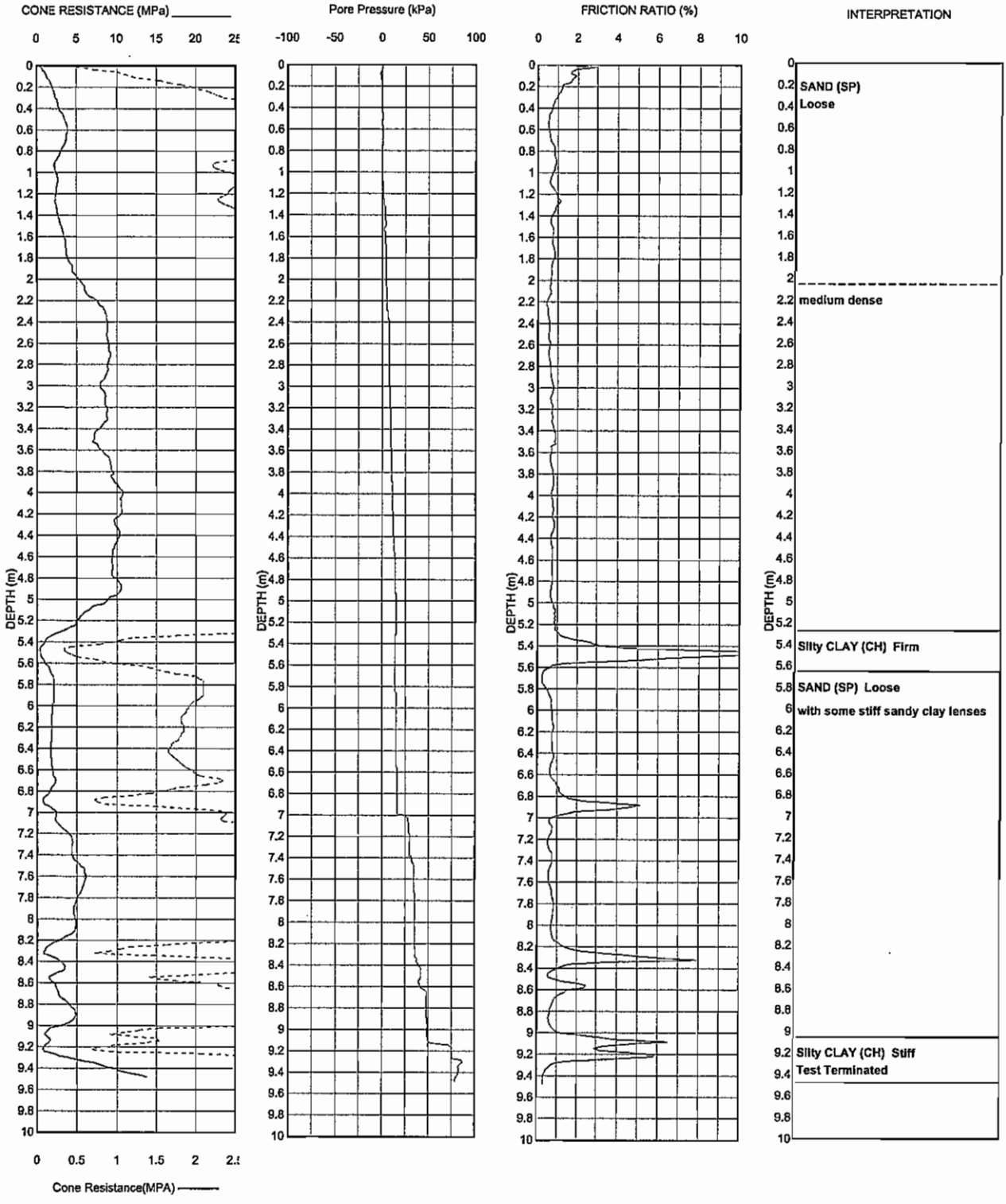


RIG	Gemco HP7	SUPERVISOR	Bob Champ
		CONE TYPE	10 sq cm Geotech (3390)

Cone Penetrometer Test Record

Soil Surveys Engineering Pty Ltd
A.C.N. 054 043 831

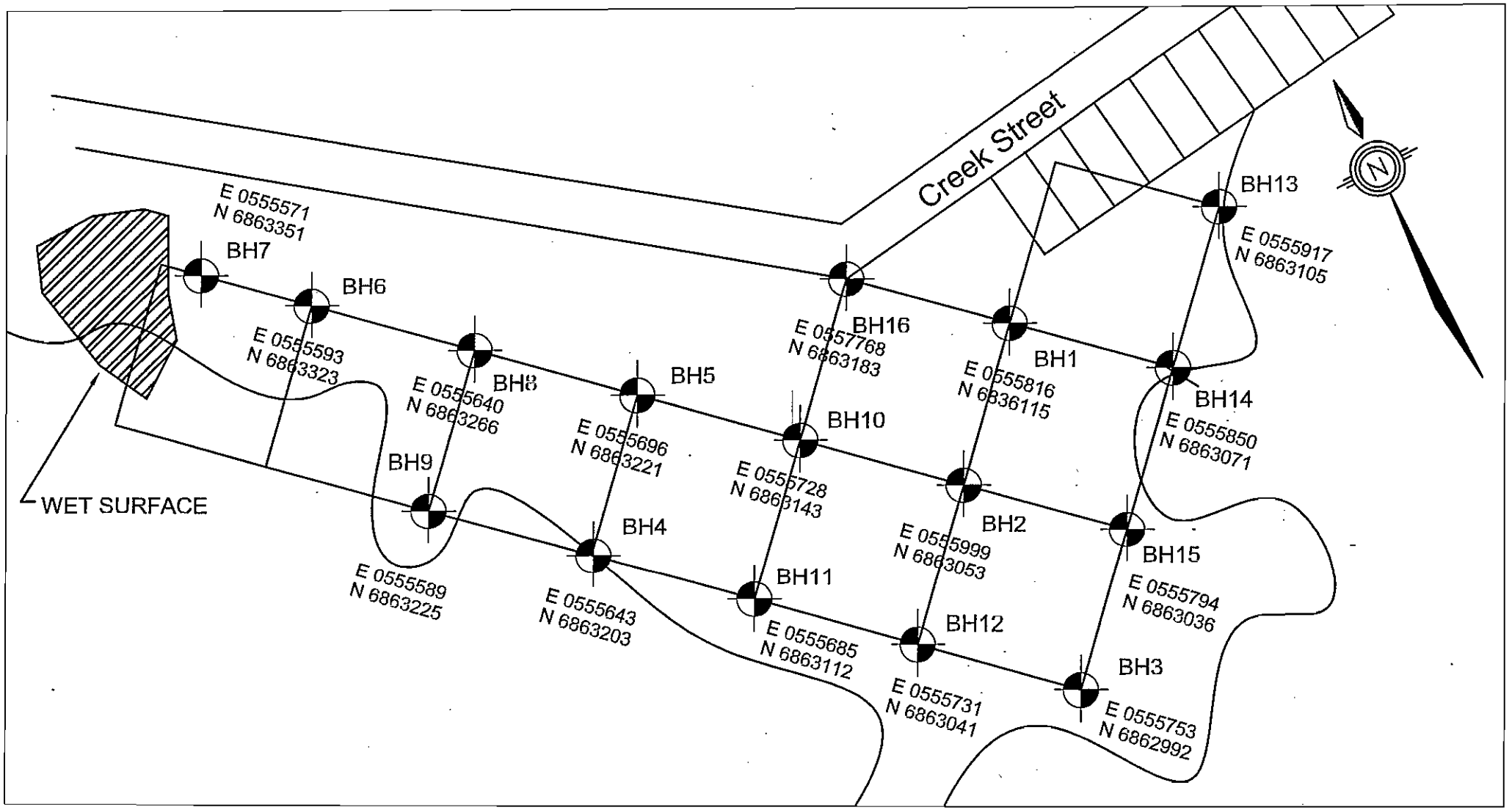
JOB No	- 204-4808	CONE NO.	- CPT 8		
CLIENT	- Walter Elliott Holdings	SURFACE R.L.	-		
PROJECT	- Proposed Subdivision	CO-ORDINATES	-		
LOCATION	- Lot 156 Creek Street, Hasting Point	DATE	- 08/06/2004	PAGE 1 OF 1	



RIG	- Gemco HP7	SUPERVISOR	- Bob Champ
		CONE TYPE	- 10 sq cm Geotech (3390)

APPENDIX D

SITE PLAN



BOREHOLE LOCATIONS

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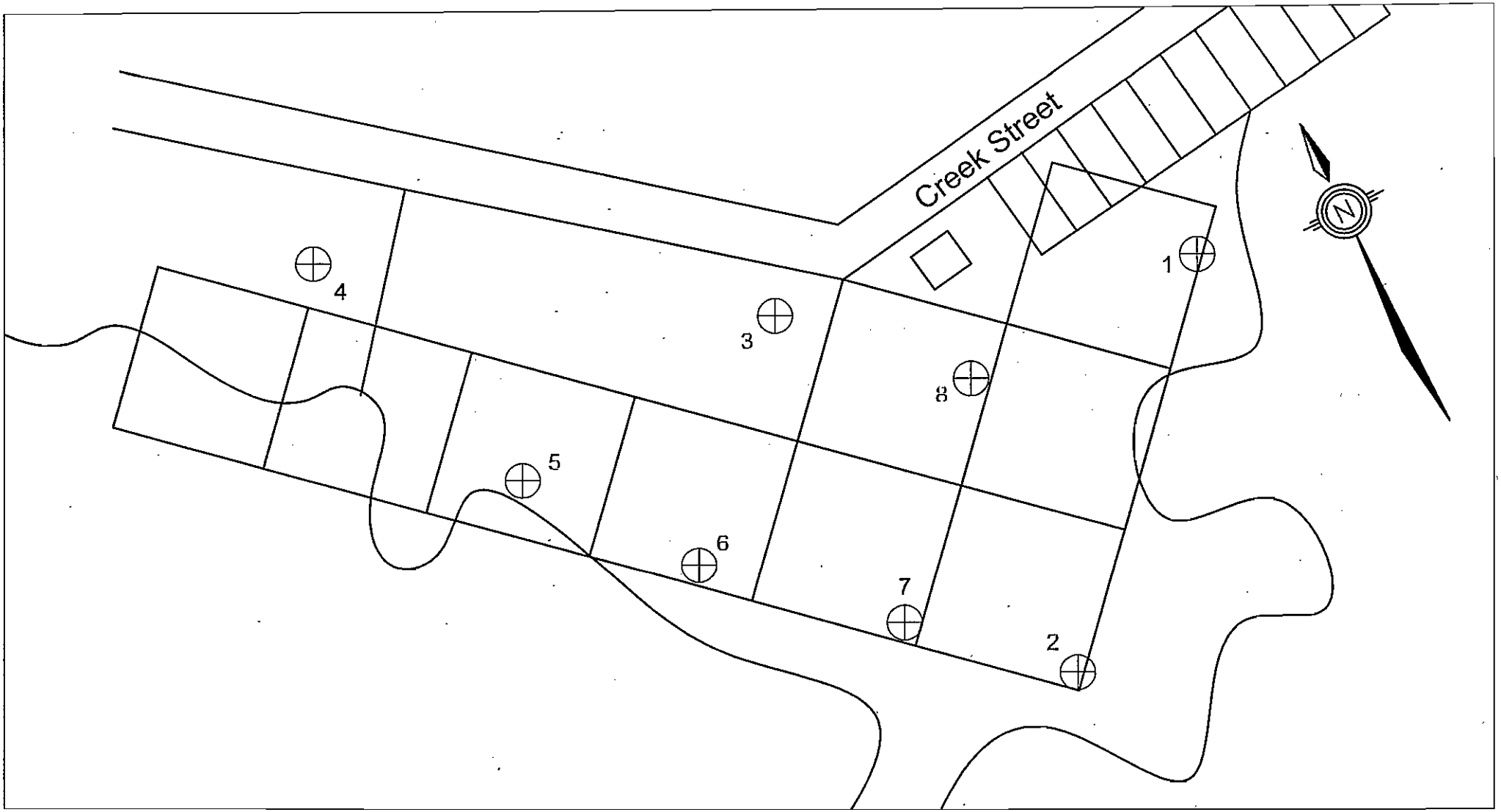
2.5 0 7.5 12.5m

SCALE 1:250

DRAWN D.D.	Soil Surveys SOIL SURVEYS ENGINEERING PTY.LIMITED CONSULTING GEOTECHNICAL ENGINEERS		
DATE 24.06.2004	SITE PLAN Proposed Filling Creek Street, Hastings point N.S.W.	DRAWING NO. 204-4808 -01	A4
CHECKED AMR			



CPT Locations

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SCALE 1:250

DRAWN D.D.	Soil Surveys SOIL SURVEYS ENGINEERING PTY.LIMITED CONSULTING GEOTECHNICAL ENGINEERS		
DATE 24.06.2004	SITE PLAN Proposed Filling Creek Street, Hastings point N.S.W.	DRAWING NO. 204-4808 -02	A4
CHECKED AMR			